WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. I.—No. 13.] SATURDAY, JUNE 15, 1889. [PRICE ONE PENNY.

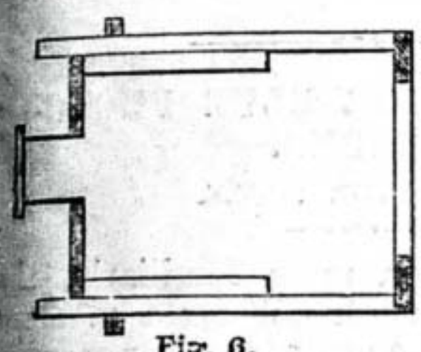
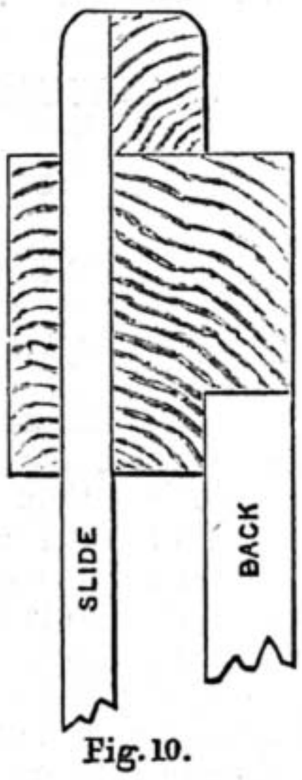


Fig. 6.



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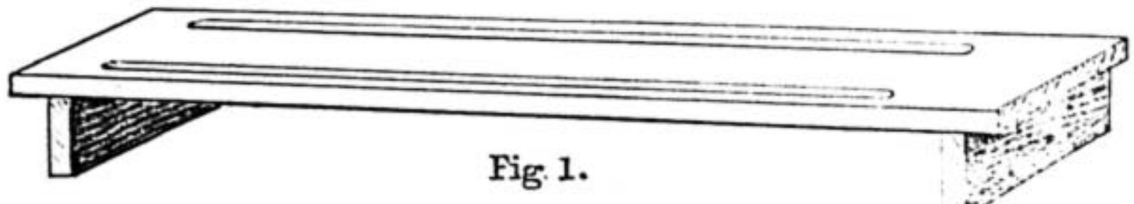
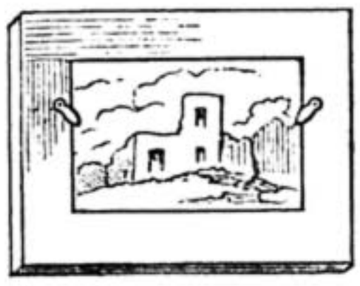


Fig. 1.



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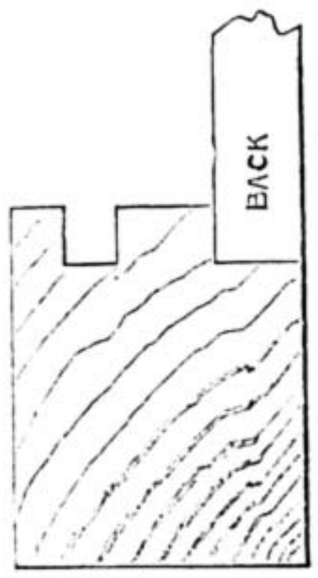


Fig. 9

Fig. 4.

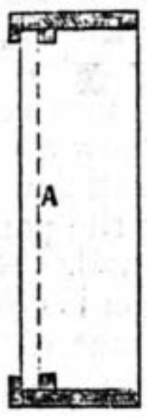
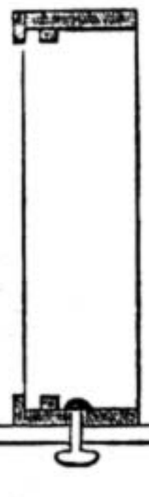


Fig. 2.



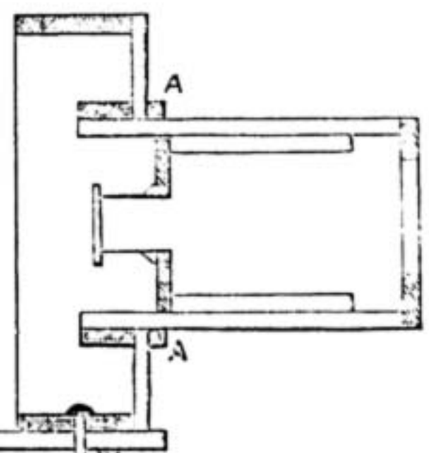


Fig. 11.

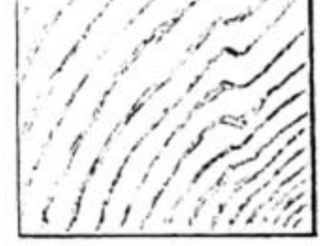


Fig. 8.

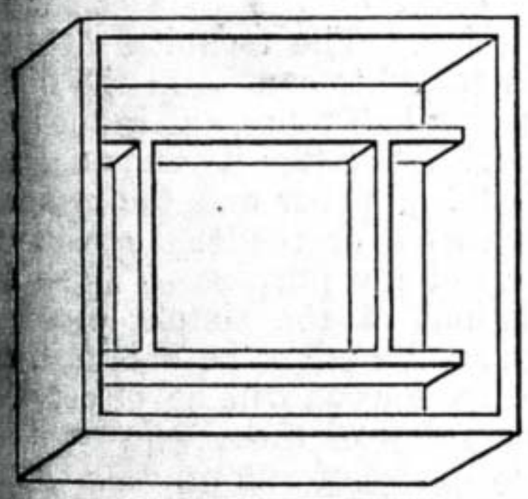


Fig. 5

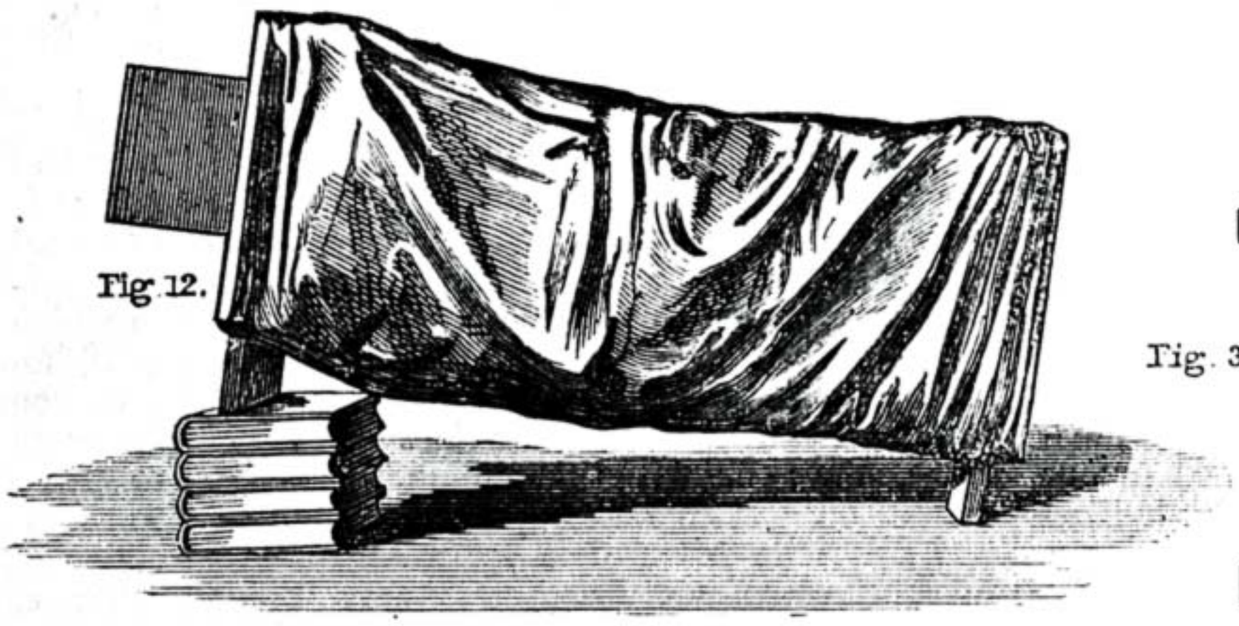


Fig. 12.

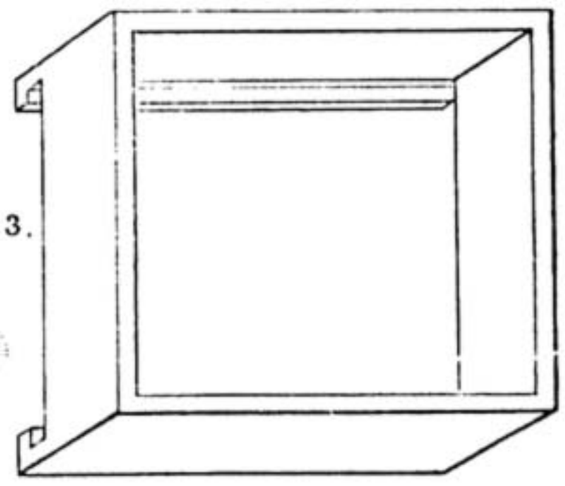


Fig. 3.

Fig. 1.—Baseboard, Perspective View, showing Elevation also. Fig. 2.—Camera Back: Section. Fig. 3.—Ditto: Elevation. Fig. 4.—Camera Front: Section. Fig. 5.—Interior of ditto: Elevation. Fig. 6.—Sliding Box for Front of Camera: Section. Fig. 7.—Carrier for Negative. Fig. 8.—Ground Glass Frame: Section. Fig. 9.—Dark Slide Framing: Section. Fig. 10.—Top End of Dark Slide. Fig. 11.—Camera Complete: Section. Fig. 12.—Camera in Position for Enlarging.

A CHEAP ENLARGING CAMERA.

BY G. LE BRUN.

INTRODUCTION—MATERIALS—CAPACITY OF CAMERA—BASEBOARD—BACK AND FRONT—BOX—GROUND GLASS AND DARK SLIDE—SILESIA CLOTH—INTERIOR—HINTS FOR WORKING—USE OF MAGNESIUM LIGHT—RULING GROUND GLASS—ADJUSTMENT OF PARTS OF CAMERA.

ALMOST every amateur photographer, whose kit consists of a quarter or half-plate set, after a time feels a yearning for larger pictures than he can produce with his apparatus; for, however artistic and beautiful his pictures may appear when mounted on cards, or in the album, they are too small for wall decoration, and could scarcely repay the expense of framing, being completely dwarfed when hung beside larger works. Now the great majority of amateurs are workers of small sizes, and of this majority the greater number are tied to size, more on account of expense than from choice; while the difficulty of getting a suitable room that can be darkened for the purpose of daylight enlarging, and the high cost of enlarging apparatus for artificial light, render the practice of this part of their chosen art out of the question.

Now, I have "been there;" I could only utilise a room for enlarging that had two very large windows, and a fanlight over the door; I tried the blocking out of daylight by making frames to fit the windows and covering them with brown paper. But, oh! the valuable time I lost in the attempt, and the stuffing of dusters, etc., into crevices to shut out straggling rays that would force their way in, till I found the game not worth the candle. Then, as my purse was unequal to the purchasing of an enlarging camera, I set my wits to work and devised the simple apparatus that I will endeavour to describe in this paper. When made, I found the process of enlarging easy and pleasant, and a most engrossing pastime.

The materials required are not expensive, the entire cost of the whole being under five shillings. The construction is easy, and quite within the powers of the merest tyro in carpentry who can handle a few simple tools, while the results are equal to any that can be got from apparatus costing many pounds; and the amateur who devotes a little time and perseverance to its construction will find himself the happy possessor of a useful appliance, and be able to decorate his walls with capital enlargements from his small negatives.

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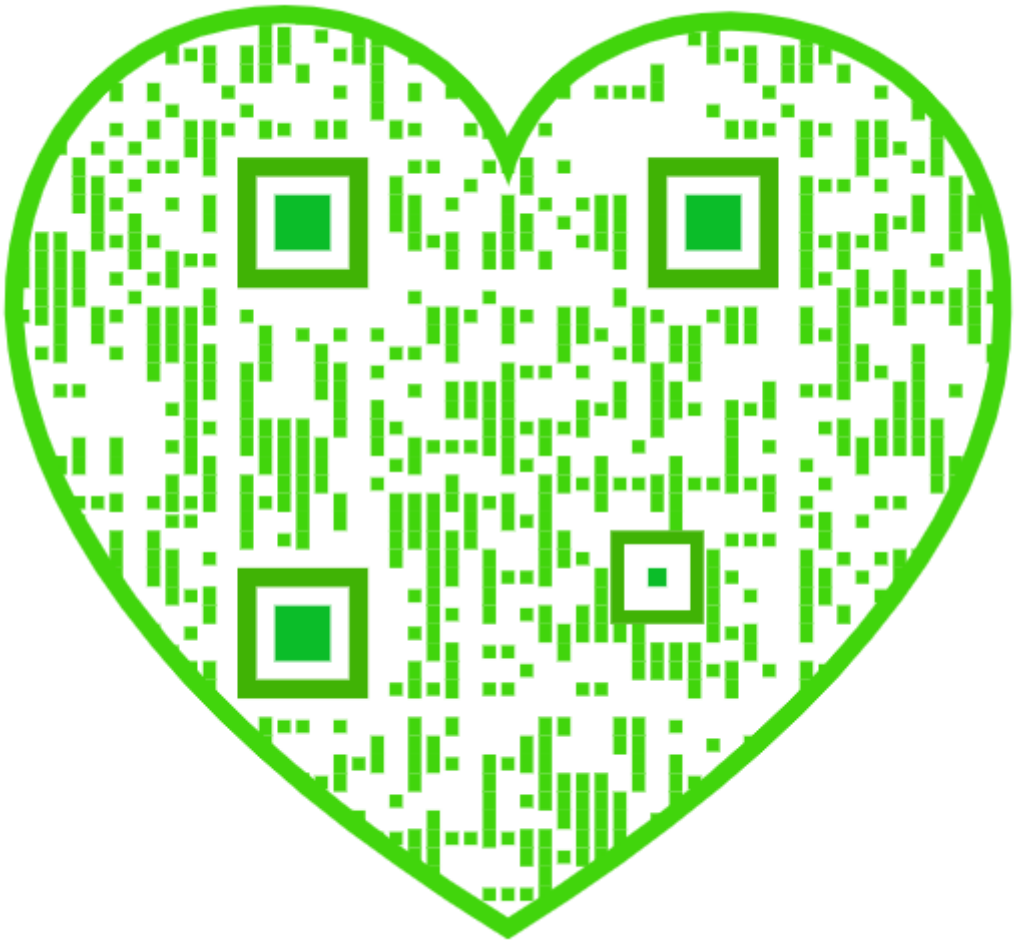

The particular apparatus I describe is made to enlarge up to 12½ in. by 10½ in., and of course to take any smaller size, but the size can be increased to suit individual requirements, the principle of construction remaining the same.

Referring to the accompanying drawings, Fig. 1 represents the baseboard, which is 3 ft. in length, 11 in. wide, and 1 in. thick; a piece of 1-in. wood, 4 in. wide, is screwed on the under side at each end to serve as supports, and also to prevent any tendency to warp; two slits, ⅜ in. wide, are cut 1 in. from and parallel to each edge of the board; these slits extend from within 3 in. of one end to 9 in. of the other end, and are for the screw bolts securing the back and front of the apparatus to slide in.

The back and front of the camera, as I suppose we should call it, are made of pine 4 in. wide and ⅝ in. thick, their outside size being 15 in. by 13½ in. The back is shown in section in Fig. 2, with the fillets for holding the dark slide, one of which is put on the edge, the other on the inside. Of course it will be noticed that one end of the back must be kept ⅞ in. narrower than the sides and other end to allow of the insertion of the slide; this is indicated by the dotted line, A, in Fig. 2. Fig. 3 shows the back of the camera complete.

Now for the front, which is shown in section at Fig. 4, and in elevation at Fig. 5. It is somewhat more complicated than the back, as an opening has to be arranged for to allow the box carrying the lens to be attached, and the front side has to be closed in. By referring to the figure it will be seen that two pieces of wood run right across between the ends, and they again have two pieces between them, thus forming an opening the size of which is 9 in. by 7½ in., which must be exactly in the centre of the front; the slips of wood used for this purpose are 2 in. wide and ½ in. thick; the spaces between them and the sides of the front are covered in with pieces of ½-in. wood, leaving the opening clear.

A box must now be made to fit the opening tightly, the length of which is 9 in.; it is made of ½-in. wood, and, when finished and fitted to its place, should have a small fillet put round the outside to prevent any light entering through the joint (A, Fig. 11). This box has no ends, and another box must be made to slide easily within it; this inner box is only 5 in. long, and is closed in one end, in which a hole is cut, and small fillets are put on the outside to allow of the insertion of the sliding front of your small camera and its lens, and, when fitted, which should be done as correctly as possible, a piece of black velvet is glued round the open end of the box so as to make it tight when in position. Fig. 6 shows these boxes in section with the negative carrier on the end of the larger one. This negative carrier is a piece of wood fitted to one end of the larger box, and having a hole cut in the centre of it large enough to carry the negative: of course, if you are going to enlarge from both quarter and half-plate negatives, you will have to make two carriers, one for each size. The hole must be cut with a small rebate of about ⅛ in. to hold the negative, which is held in its place by two small turn buttons as shown in Fig. 7; the carrier itself is held in position by a hook and eye on each side.

Two pairs of 2½-in. screw bolts with thumb nuts must be got; a pair of these are put in the bottoms of the back and front of the camera to coincide with the slits in the baseboard; small washers should be put on each screw bolt so as to prevent the nut destroying the wood on the underside of the baseboard when screwed up.

A ground glass back and a dark slide are now to be made; they are shown in section in Figs. 8 and 9 in full size. The back of the dark slide is made of wood $\frac{5}{16}$ in. thick, while the sliding front is simply a piece of thick millboard. I use millboard in preference to wood, as it is not so liable to warp; a piece of wood is glued across the top of the slide so that when it is closed no light can enter through the joint. (Fig. 10.) The ground glass being put in the frame and neatly puttied in, the camera is complete, so far as the woodwork is concerned, and can be put together, when it presents the appearance shown in section in Fig. 11.

Four yards of black silesia cloth are now bought (costing about sixpence per yard); this is doubled and sewed along the edges, then the ends are sewn together, and you have a bag with open ends; slip this bag over the front and back of the apparatus to serve in lieu of bellows, securing it by tying with tapes round the camera, put in your lens, and you are ready for enlarging.

The paper is secured in the dark slide with a drawing pin at each corner, and, as there is plenty of room between the back and the front of the slide, glass plates or opals can be manipulated, securing them in the same way as the paper.

The inside of all the woodwork must be stained a dead black; this is best accomplished by coating it with a mixture of lamp black and turpentine, adding a few drops of terebene to ensure drying. The whole of the outside wood I stained and varnished to represent mahogany. Instead of using silesia cloth, workers with plenty of spare time can of course make a bellows, but the labour entailed is great and the job messy; while the cloth bag is easily made and serves every purpose.

In focussing, slide the back of the camera only, keeping the front rigidly fixed in position; when the picture is sharp on the ground glass secure the back by means of the thumbscrews. To facilitate focussing I have drawn lines ¼ in. apart at right angles across the baseboard; these lines serve to guide the worker, as when once he has focussed a particular size of picture by marking the line at which the back was, he will have no trouble next time in finding the focus for that particular size.

When working with this camera I generally put it on a table close up to the window, and raise the front of it by placing a few books underneath, so that it may point towards the sky, and obviate the risk of getting a few stray chimney pots or tree tops in the picture that are not in the negative; when thus used the whole apparatus looks like Fig. 12.

As all the parts separate, it is easy to pack the camera away on a shelf or in any odd corner, and, as the trouble of putting it together is small, it is always ready when wanted. It has also the additional advantage that its use is not confined to daylight. I have got some very fine enlargements on Ilford rapid paper at night by placing a piece of white tissue paper in front of the negative and burning 18 in. of magnesium wire at 6 in. distance, waving it slowly in front of the negative so as to diffuse the light equally over the picture.

I would suggest that the ground glass be ruled with lines corresponding to the various sizes of paper, and the inside of the dark slide with exactly similar lines, so that when a picture is focussed on the glass the paper can be put in the slide in exactly the right position, and thus obviate the danger of getting only about two-thirds of the picture on the paper, as I did several times before adopting the lines. Care must also be taken that the back and front of the camera stand perfectly perpendicular on the baseboard, and also parallel to each other, as if they do not distortion and fuzziness will be the result. I say nothing about the *modus operandi* of enlarging, as that can be found in any elementary book on photography.

I have no doubt if any photographic enthusiast makes and uses a camera of this simple description he will be thoroughly satisfied with the work he can do with it, and the ease with which it can be used, while its inexpensiveness will commend it to all who have large aspirations and small purses, as is most unfortunately the case with the writer.

CYANOTYPES OR BLUE PHOTOGRAPHS.

BY L. IVOR POOLE.

THE Cyanotype—or, more familiarly, the blue process—although not for a moment comparable with the ordinary silver or other A1 methods of producing photographic prints, so far as highly finished pictures are concerned, has, nevertheless, so many good qualities, that many who waste a good deal of time with more complicated processes might well bestow a small amount of attention on it with satisfactory results.

The preparation of the paper is extremely easy, and the cost small. No toning is required, and the fixation is effected by simply washing the print in water. The process is most useful for copying fretwork and other designs, these being used as negatives from which to print; and it is perhaps better adapted for such work than for the production of photographic pictures as these are ordinarily understood. Still, for many photographs, the effect of the blue colour is decidedly pleasing. The technical defects may be briefly stated to consist in the difficulty of obtaining half tones, and in the loss of detail, though this latter depends a good deal on the kind of paper and the manner in which it is coated or rendered sensitive. It is, however, not my purpose so much to give complications of the simple process, although finer results might be obtained, as to give such directions as will be of service to the vast majority of those who want a cheap and easy means of sun printing.

The chemicals required are only two in number, viz., ammonio-citrate of iron, and ferri-cyanide of potassium ($K_6F_{e2}C_{12}N_{12}$), or, as it is sometimes called — the *red* prussiate of potash, to emphasise the difference between it and ferro-cyanide of potassium ($K_4F_eC_6N_63H_2O$), the yellow prussiate, which is of no use for the purpose. Both the iron and potash preparations are to be obtained through any druggist; but the red prussiate, not being used medicinally, may not be so familiar as the yellow prussiate to the ordinary chemist. It is to this cause the want of success sometimes complained of with the blue printing process may possibly be attributed—one prussiate having been used instead of the other.

An ounce of each will be ample to sensitise a large quantity of paper, and as they are both very cheap it will scarcely be worth while to purchase in smaller quantities. Great care, however, must be used with the prussiate, as it is a most deadly poison, and should never be carelessly left lying about,

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or where it might be mistaken for something harmless.

Whatever the quantity, the proportions are as follows:—Four parts of water to one part of each chemical, thus—1 oz. ammonia citrate, 4 oz. water; 1 oz. prussiate, 4 oz. water. The chemicals are readily soluble in water, so there will be no difficulty about this part of the preparation. The solutions should be made and kept separately, as there is then little or no risk of their becoming useless as they will do if mixed, unless they are carefully excluded from light. Some directions state that they should be mixed, and kept so ready for use; but I can see no advantage from doing so, unless that sometimes it may be more convenient to have one bottle than two. Even when unmixed, it will be just as well to keep the solutions in a dark place, though I have never found that a moderate amount of light does them any harm. Immediately before using—that is, applying them to the paper—equal quantities of each solution should be mixed, and not exposed to any strong daylight. It is not necessary to work in the ordinary photographic dark-room—that is, one illuminated only by ruby or orange light. It will be quite safe to use a moderate amount of gas or candle-light; or, in the daytime, to partially darken the room by drawing the curtains to or the blind down.

The mixture should not be effected till the paper is ready waiting to be coated.

A good deal has been said, and may be said, about the kind of paper best suited for the cyanotype process. For ordinary reproductions there is, however, no occasion whatever to be very fastidious about its make or quality, as any that is non-absorbent will answer. Naturally more care will be given if a print of a picture is wanted than if it is merely a design for fret cutting. I have frequently used ordinary writing paper and found it do very well. The better the paper, or perhaps it will be more correct to say, the harder and finer its texture, the better the print will be. The kind known, I think, as bank post, which is hard without much sizing, is perhaps the best. Of course, when pictorial effect is aimed at, paper free from water marks should be used.

A very small quantity of the liquid is required to sensitise the paper, on which it should be painted rather than rubbed in. Some advocate that the paper should be damped first, but this is not necessary. It prevents the paper curling up when the sensitising solutions are applied, but otherwise it only complicates the process.

The paper may be sensitised by either floating on the solution or by painting it on. A sponge may be used, but I prefer a large-sized camel-hair brush—one such as is used for damping the pages of press-copying books—to any other kind. The brush should be washed out directly afterwards, and may then be used for its ordinary purpose without suffering any injury.

Some small amount of care will be required to get the solution evenly spread over the paper, which, when coated, should be laid by in the dark to dry. It will, if protected from light, keep for a considerable time, though it does not improve, and on that account more should not be prepared than is likely to be used within a limited period. The fresher it is, the more quickly it prints, and the purer will be the high lights or white parts of the picture.

The exposure is made in an ordinary printing frame, and will be much longer than for silver prints, say from five or ten minutes in a bright sun with quick-printing negative, to several hours. The brighter the light, the more brilliant will be the picture, of course, provided that the exposure has not been unduly prolonged; as, if so, the high lights, instead of being pure white, will be tinted with blue. A bold, "plucky" negative gives the best results, while from a thin one it is hardly worth while taking a blue print.

The exposure must be prolonged till the darkest parts assume a greyish metallic appearance, the middle tones being decidedly a dark, but by no means a brilliant, blue; while the high lights remain much as they were originally, viz.: greenish hue, much lighter than any of the other portions of the print. Perhaps the best way for a novice to note the different colours, will be to lay a piece of the paper uncovered in the sun, and note the changes which take place. There will then be no difficulty in recognising the final depth to which the print should go. It will be understood that the image becomes visible, though detail is to a great extent lost.

To complete the print it is only necessary to wash it thoroughly in water till this runs off clear without any yellow tinge. So long as there is any yellow in the water which drips from the print, washing must be continued. The most convenient way to wash the prints is to hold them under the tap and let the water flow over them. This part of the process does not take more than a few minutes, during which the unfixed chemicals are washed away, leaving the high lights perfectly white and the remainder of the picture in shades, down to deep intense blue in the darkest shadows.

In conclusion, I may say that I have found that by holding the print under a tap of hot water the clearing and fixing are much expedited, the print being developed with an almost startling rapidity, which, in the case of an ordinary negative, would more than suggest over-exposure.

A "CHEVAL SCREEN" ESCRITOIRE.*

BY J. W. GLEESON-WHITE.

THERE are divers attributes required of furniture. One man I know always cries out for "stable" fittings. He does not mean, I find, that he wishes racks and mangers in his drawing-room, but that his upholstery should be of a rigid and monumental character. At once I must confess that the piece of furniture herein to be described would hardly meet his requirements; yet the original cabinet which supplied the motive of this combined screen and escritoire, was, at least, a hundred years old, possibly more. If our construction lasts out the century—not this century, but the hundred years from date—it will, probably, outlive our reputation, most likely our very memory. The individual who writes, and the one who is now kindly reading it, will most probably be entirely gone from human knowledge by 1989. If only space allowed, this theme would be a much more tempting subject to display one's newly acquired odds and ends of information, furbish up one's old stock of trite aphorisms, and moralise vaguely and generally, like the leading article of a sensational daily on New Year's Eve.

This piece of joinery is of somewhat ambitious order; it should not follow a rabbit-hutch, the ordinary first work of the youthful carpenter, unless the rabbit-hutch was a *very* good one. And if the tool chest is limited to a sort of hammer, a saw that makes excursions upon erratic anatomical deeds of daring in the back kitchen, and a bradawl that frequently (eager to do a little more than is required of it) attempts to fulfil the purpose of the nail, by staying firmly in its hole and parting company with its handle—the work had better not be attempted. This great triad of amateur tools must not be too lightly spoken of; they do a lot of mischief, and little good (like most of us), in the course of a year. Even as Mrs. Partington's mop, that was excellent for a puddle, but of doubtful good to drive back the encroaching waves of the Atlantic, these tools may be left to those whom they satisfy. But for the skilled amateur, whose work, by reason of special tools, ample time, and general good taste, is often quite equal to the very best professional work, there is no hidden mystery in this cabinet, which demands only good work of ordinary joinery: no angles fitted on Euclidian, unlikely, radiating lines; no curved work or elaborately-wrought turnery; only ordinary mortise and tenon, dovetail and mitre; yet since its purpose is for "my lady's chamber," it must be finished just as neatly as the craftsman is able to do it.

One point, I own, is doubtful: whether it would be trustworthy when in use, or whether, by a simple arrangement suggested in Fig. 3, it would not be needful to provide more support for the weight of the arms of the writer on its desk. Of course, it might be screwed to the floor; since it is a bric-à-brac what-not as well its movability is unimportant, and a single screw at each foot would not seriously affect the carpet, nor make it an awkward fixture in "spring cleaning." Of course, the legs might project more; perhaps that is the simplest way to overcome the difficulty; but in the original, so far as a hurried inspection serves, the general dimensions were about those given here, certainly not more spread out at the base.

The whole character of the design being somewhat Japanese, I would suggest either a red lacquer-like finish, or if that be too *outré*, and its alternative, black and gold, is impracticable or disliked, then, walnut holly, with satin or other light wood for the panels, might be adopted. The panels of the door and escritoire top, as suggested, are for inlaid work; better still, of real lacquer. Shops for the sale of Oriental goods have often damaged tea-trays that are procurable cheaply and cut up well for this purpose, or panels finished on purpose for ultimate framing. Painted decoration would also be in keeping, or the panels might be left plain. The design given is less a working drawing (although it is intended to fulfil that purpose) than a suggestion for a motive, to be varied according to the needs or will of the maker.

The whole piece of furniture should be neatly backed, either in panelled wood or with painted design; or finished by some fluted silk or other textile fabric; the idea of the structure being that it stands out, away from a wall, and showing all its sides.

Space is a valuable commodity; next to time perhaps the most in demand. Time and space are mighty words to deal with,

* When the same idea occurs to two different writers, and both make use of it according to their respective idiosyncrasies, the second in the field is set down by the charitable as a plagiarist. In Mr. Gleeson-White's "Cheval Screen Escritoire" readers will note a marvellous resemblance to Mr. Adamson's "Screen Secretary." Yet in neither case was one of them the outcome of the other. The "Screen Secretary" is followed by the "Cheval Screen Escritoire" to show how in all cases bent of mind influences treatment.—ED.

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and a suggestion to save either sounds more like a motive for a sermon than for WORK; yet, if we can save either, or both, we will risk the allusion.

I see no reason why a duplicate, as it were, of the front, minus the secretaire itself, or a neat set of shelves for books, should not be added; this would, of course, make the thickness double, but (if a bookcase) at once remove any doubt as to its stability, and give additional use to the whole thing.

I should like to explain the making of this escritoire in words, but I have done so in diagram so exhaustively (at least, so it seems to me, if exhausting and exhaustive are synonymous), that I feel like an orator talking against time, and trying to lengthen out ten minutes more when he has already said all he had to say.

The whole framework should be, as far as possible, made to fit in one construction, that is, the main shelves and uprights should all fix together, so that they may hold in their place without a nail. I mean the sort of letter-H arrangements should fit like the divisions of a drawer for birds' eggs—I forget if there is a technical term for this process—the shelf that projects on either side being one piece, bracing the two main supports, and, if possible, being fitted to the two inner supports in like fashion. But it is hopeless to put this into words; if you cannot see what I mean by the diagrams, I can only regret having not been more clear in the drawing, and will readily supply the required information in "Shop."

The lining at the back of the shelves is intended to be covered with Japanese gold leather paper or a dark plush, to set off the china and other bric-à-brac.

If the edges of the shelves can be reeded, so much the better; if they can be inlaid, better still. If in place of the simple rail, which would look well in lacquer finish, but not in any other, a turned balustrade is preferred, all the Japanese ornaments should go, and a more formal pattern be chosen for the panels—such as Adams or Sheraton used so often.

The original escritoire charmed me—it was of inlaid wood, and had an arched top and cupboards enclosing all its space; whether, in attempting improvements, I have spoilt the idea, I cannot say.

I need say nothing about Fig. 1, which, as I have said, explains itself. In Fig. 2 the central space below is converted into a cupboard. The panel of the door and of the flap above may be hand painted or fitted with lincrusta walton.

Figure 3 shows a variation from the same main lines, but with fretwork introduced for the cupboard doors, and (although not shown in the sketch) has panels in the fall-down top, which forms the writing-desk.

To conclude, I would reiterate the advice to depart entirely from the model, if wished; but, if so, do it consistently. A mixture of styles is unbearable; *no* style is bearable; any style, if adhered to, is good of its sort, but a mixed style is generally as contemptible as the word mongrel, which fitly describes it.

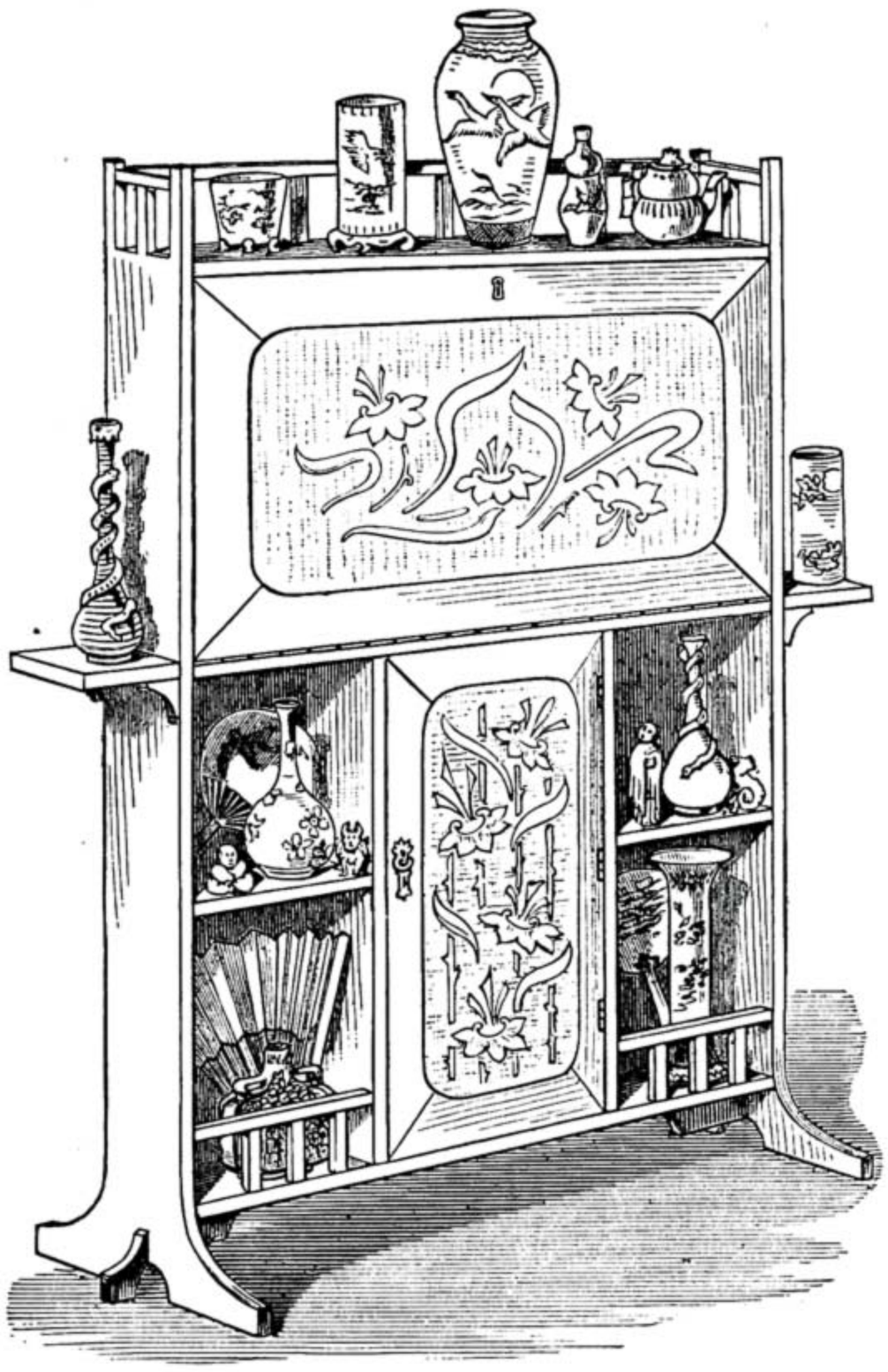

Fig. 2.—The Cheval Screen Escritoire with Cupboard and Shelves below.

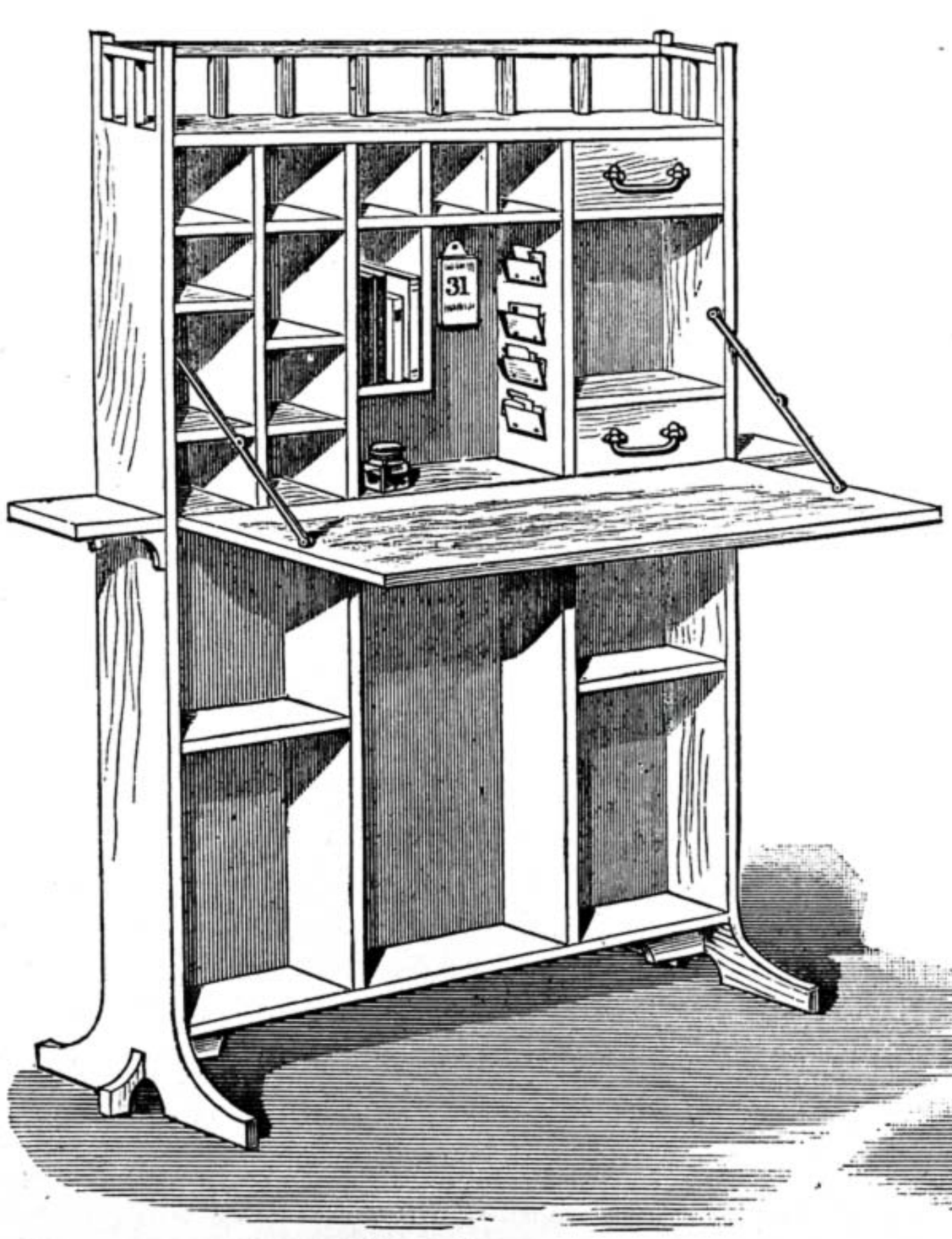

Fig. 1.—The Cheval Screen Escritoire in its Simplest Form.

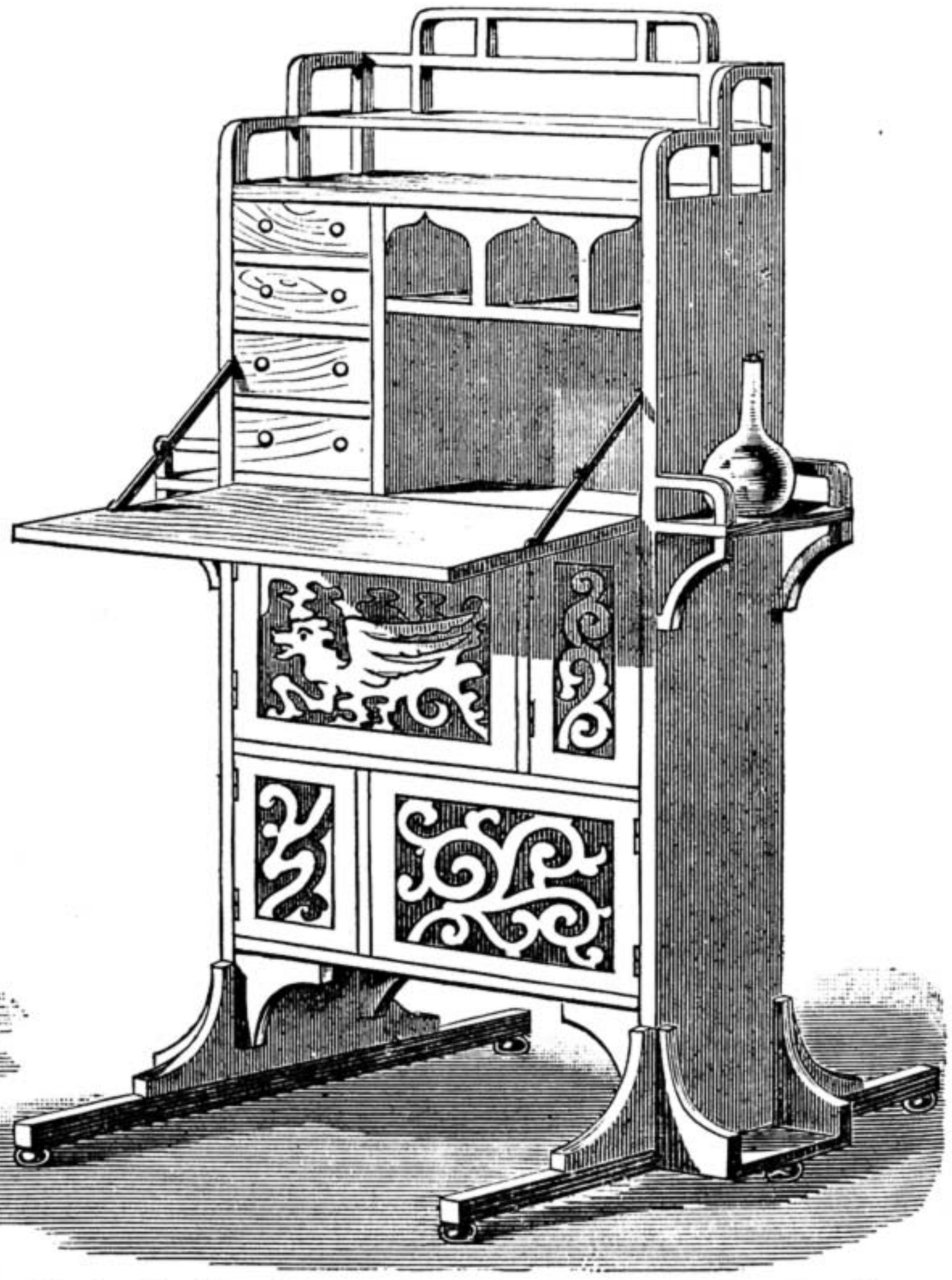

Fig. 3.—The Cheval Screen Escritoire with Four Cupboards below.

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SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

(*Continued from page* 164.)

ANALYSIS OF FORMATION OF LETTERS OF THE ALPHABET.

LET us now, in our intervals of rest from practice, consider together the letters of the alphabet as they stand in relation to the sign writer and his work, for which purpose I distribute them into five divisions, for the sake of clearness and the proper understanding of the subject.

Fig. 28.—Letters Formed of Parallel Lines at Right Angles to each other.

The easiest letters to form are those, of course, which consist wholly of straight lines, or, more properly speaking, of parallel lines at right angles to each other. These letters are shown in Fig. 28. This drawing brings us to another class of letter, viz., the sans-seriff order, which are given here in outline only. In forming letters, no given rule can be followed as to their general construction and symmetry, and for this reason—letters may be of an average width and length, or they may be "elongated" or "extended," and consequently the width between all parallel lines vary accordingly. Referring to Fig. 28 and the letters E and F, I would point out that the middle *members* (this is a technical expression used in the trade, and indicates each individual portion of which the letter is constructed, or "built up" with) should never be quite so long as the outside ones. They may be nearly so, but should never be less than one-half as long as the other members. The letter H has one horizontal member exactly in the middle of the two uprights. This should be of the same width or thickness as the rest of the letter. Mr. Ellis A. Davidson, in his book on "House Painting," and in the chapter devoted to sign writing, argues that the middle member of the H should be thinner than the horizontals in other letters; but this, although having learnt much from his book, I entirely disagree with—in fact, his own drawing disproves the theory, which, I may say, is not followed by practical men. It is one weak point in an otherwise excellent book. The other three letters are some of the easiest to form, and require no further remarks other than that the top member of the T should always be equally distributed on each side of the upright.

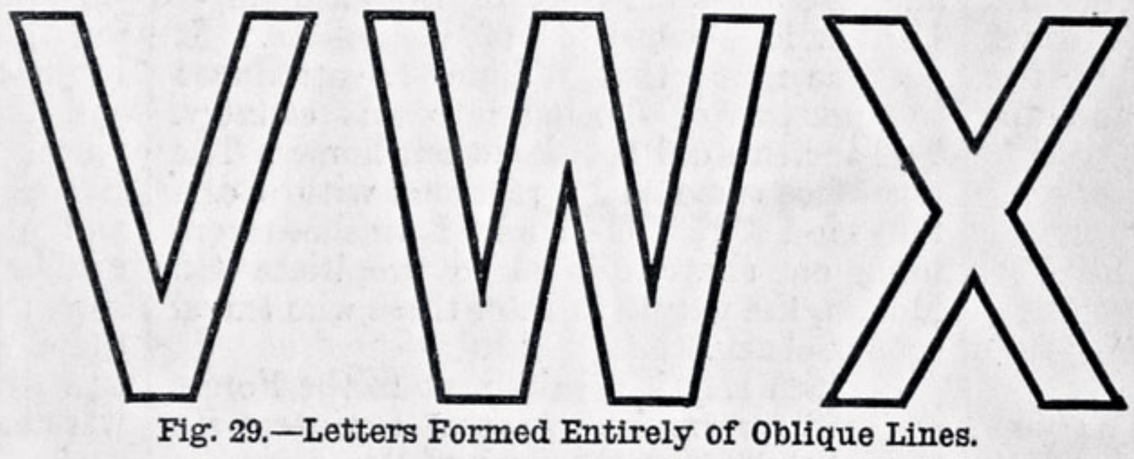

Fig. 29.—Letters Formed Entirely of Oblique Lines.

Fig. 29 shows the only three letters which are composed of slanting or oblique lines. The first, V, is not a difficult letter to form, care being taken not to give it an appearance of falling or leaning on either side, and to allow each arm or member to slant at the same angle. W, the next letter, resembles two V's joined together; it must not, however, be so wide as two V's would be if they were actually joined, or it will give a very unsightly appearance to the whole word of which it is a part. The average width of the W should be about half as wide again as the letter F or N. That is, of course, for letters of normal dimensions, as elongated and extended letters are not at present under consideration. The X is generally formed in a rectangle, and the upper triangle of the two, formed by the members crossing each other, should be a little smaller than the lower one, but very slightly so. The lower portion, however, must never be the smaller of the two, or the letter will look ugly and top-heavy.

Fig. 30.—Letters Formed with Combined Vertical, Horizontal, and Oblique Lines.

The letters which are formed of vertical, horizontal, and oblique lines combined with each other are given in Fig. 30. The A is simply a V inverted with the addition of a cross member. This should be nearer the bottom than the top, as shown in the drawings. The K is a somewhat difficult letter to draw to give it a pretty appearance. There are various ways of drawing it, which depend greatly on individual taste; the one given here, however, is that which is generally accepted as the true style, at least for all plain lettering. The M is, of course, a wider letter than the N, but the middle member should not be shortened, as we sometimes see it, but allowed to come right down to the base line. Some writers have compared this letter to the letter V, supported on each side by two perpendiculars, the outer lines of the V starting from about the middle of the top of each of the vertical members. This is a very good description of the letter. The way to draw the N is to make the perpendicular lines equal in width, and then to draw the oblique one from the innermost angles. The letter Y is fashioned after a V, but supported on a single leg or stem, and Z is formed within a rectangle. We next come to letters made up of both straight and curved lines (Fig. 31). The B and the R are very similar in construction, the only difference being that in one case the lower member curves inwards and in the other it curves outwards. In B the lower curve should always be slightly fuller than the upper one; it is thus prevented from having a top-heavy appearance, and looks altogether more solid. The D consists of a perpendicular and one full curve, the P of a perpendicular and a half-full curve, the J a perpendicular with a curved base, and the U a curved base continued into two perpendiculars. I have purposely left the five most difficult letters to the last, and these consist entirely of curved lines (Fig. 32). It

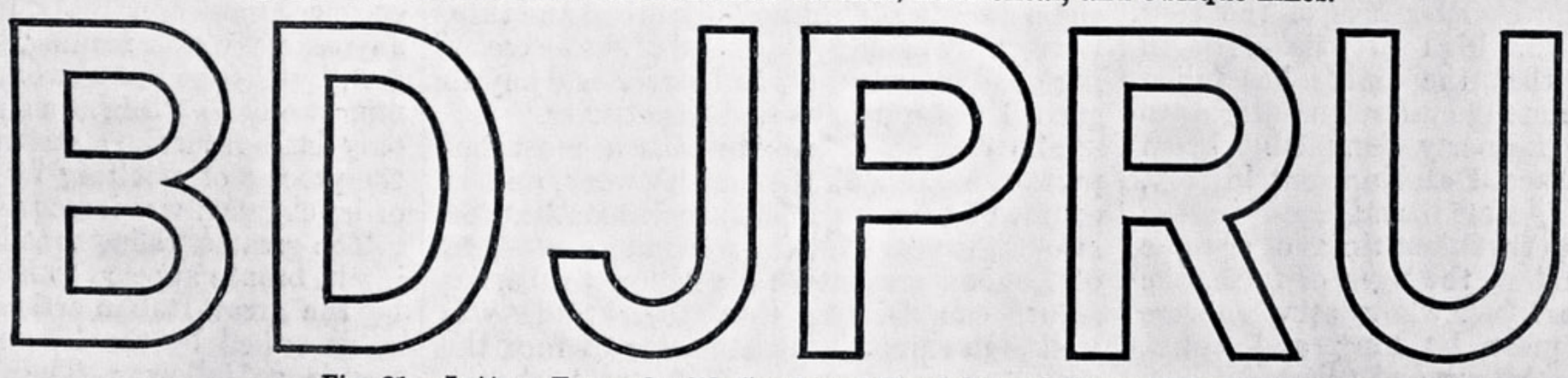

Fig. 31.—Letters Formed with Combined Straight and Curved Lines.

Fig. 32.—Letters Formed of Curved Lines alone.

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should here be pointed out that the O is the foundation or base upon which is constructed the C, G, and Q, and that the O should be a perfect ellipse. The S is the most difficult letter for a novice to draw, but if he has been assiduously practising the freehand lessons, he should soon be able to give it a graceful rendering without any extraneous aid. Having so far eschewed any reference to the mechanical ways of drawing letters, it would be out of place to give any directions here for treating the S in this manner; suffice it to say, therefore, that the letter should be contained within a parallelogram, and that it should have a proportionate appearance throughout. Of course, if the learner so wishes, he can at once adopt certain guide lines for the correct drawing of this letter, but it is not recommended, for—to quote a well-known authority—"if the eye be not trained to a correct perception and an accurate discrimination, and if the hand has not, as the result of experience, the power of exact definition and precise demonstration, the ultimate result will be indefinite and unsatisfactory."

SMITHS' WORK.

BY J. H.

(*Continued from page* 147.)

POSITION OF THE SMITH IN ANCIENT NATIONS—FORGING OF ARMOUR—ARTISTIC METAL WORK OF MEDIÆVAL TIMES—CASTINGS IN METAL AND BRONZE—HAMMERED METAL WORK—CANDELABRUM IN MILAN CATHEDRAL—FITTINGS OF DOORS AND GATES—CAUSES OF MANY-SIDEDNESS OF OLD ARTISTS—INFLUENCE OF RELIGION.

THE smith was far and away the most important craftsman of ancient and mediæval times. It is only since the modern perfecting of the processes of casting, and because of the introduction of machines for the simplification of many of the operations of smiths' work, and also because of the very small demand for high artistic work in malleable iron, that the smith has fallen into a position among craftsmen inferior to that which he formerly occupied. From the periods of sacred and ancient history, down through the mediæval ages, in the wildest and most turbulent times of crusade and chivalry, and in the ages of faith, the smith was the artificer whose services were in constant request by king and court, knight and pope, bishop and priest.

In ancient times one of the greatest evils by which a conquered people could be afflicted was the deprivation of their smiths.

When the Philistines conquered Judea they captured the smiths, "lest the Hebrews make them swords and spears." And the Israelites then "went down to the Philistines to sharpen every man his share, and his coulter, and his axe, and his mattock."—1 Sam. xiii. 19, 20.

When Jerusalem was taken by the Babylonians, they adopted the policy of carrying away the smiths captive to Babylon (2 Kings xxiv. 16).

Cyrus, after the conquest of the Lydians, ordered that no weapons of war should be kept in their possession.

In the peace which Porsena granted to the Romans he stipulated that no iron was to be forged, save for purposes of agriculture.

In the old chronicles and romances the smith figures as a conspicuous and important individual. As a maker of swords and armour, or forger of chain and plate mail, he was of the highest value in turbulent times.

The Romans worked and smelted the iron ores of this country extensively. Their cinder heaps have been found in North Derbyshire, North Yorkshire, Northamptonshire, in the Forest of Dean, in South Wales, Sussex, and other districts, and the smith was a mighty man both in the armies and in private dwellings.

In Anglo-Saxon times the smith was treated as an officer of the highest rank, and took precedence of the maker of mead and of the physician. In the ancient Welsh Court he sat near the king and queen, next the domestic chaplain.

Weland the Saxon Vulcan was a smith who is reputed to have forged the sword "Galatin" of Sir Gawain, and "Joyeuse" of Charlemagne. Among the Northern nations traditions of magic swords, the work of the smiths, long lingered.

William of Normandy brought over smiths and farriers with him to Britain, and the coat of arms of the earldom of Ferrers long consisted of horseshoes. It may be noted that William I. introduced the practice of shoeing into this country. The ancients did not shoe their horses. The horseshoe came to be regarded with a certain kind of reverence, and horseshoes were hung on church doors to propitiate St. Martin, the patron saint of those who travel on horseback.

Edward III., it is said, sent to the Forest of Dean for smiths to act as engineers for the royal army at the siege of Berwick.

In Edward III.'s reign the pots, spits, and frying pans of the royal kitchen were classed among his majesty's jewels.

Readers of "Waverley" will call to mind Andrea de Ferrara, a great smith in Highland story. He is said to have worked in a dark cellar, the better to observe the colour necessary for the tempering of his blades. He could temper a sword so that by bending, the point might touch the hilt and spring back uninjured. Patten describes these swords as "all notably broad and thin, universally made to slice, and of such exceeding good temper that, as I never saw any so good, I think it hard to devise better."

The forging of armour was a most important section of the smith's work, and in course of time became a separate craft. So late as the year 1690 the workmen armourers of London presented a petition to Parliament, complaining that their trade was well-nigh ruined. As a matter of fact, the use of armour nearly died out with the Commonwealth.

Armour was used by the Anglo-Saxons, but the Normans employed it more extensively than did the conquered people, elaborating it until they became clothed *cap-à-pie*, and their steeds were largely encased also in armour.

Some of the ancient armour in the Tower is well worthy of close study. Helmets and visors, breastplates, gauntlets, greaves, and so forth, are marvellous specimens of handwork—everything so thin and light, yet so strong withal. The chain mail is the older, having been superseded by the plate armour in the fourteenth century. The art appears to have reached its height about the time of Henry VIII.; witness that monarch's suit in the Tower which was presented him by the Emperor Maximilian. The armour of this period was sometimes fluted, ribbed, engraved, damascened, russeted, and otherwise ornamented. As indicative of the importance of the art of the smith in the mediæval period, during which its ascendancy was supreme, we note that in 1282 there were seventy-two forges leased from the Crown by iron smelters in the Forest of Dean alone. No marvel that the name of Smith or Smythe is so common. And the Scotch have their Gowans or Cowans, the Germans their Schmidts, the Italians their Fabri, the French their Le Febres or Le Fevres. There are also the Nasmyths, the Arrowsmiths, Goldsmiths, blacksmiths, whitesmiths, etc.

But the demands of the men-at-arms by no means occupied the whole time, or exhausted the skill of the smiths of the Middle Ages. There were arts of peace as well as of war, and there were the vast demands of the wealthy and ubiquitous Church. Craftsmen and artists—and the terms were often synonymous—vied with one another in rendering her service. The labours of workers not only in iron, but also in brass, copper, and the precious metals, were pressed into her service.

Byzantium early became a great centre for the production of artistic metal work. From thence the art spread, in the ninth and tenth centuries, to the Rhenish provinces of Germany, to Italy, and Western Europe. Bronze doors, altars, candelabra, and other ecclesiastical adornments commanded the highest skill of the Middle Ages; and untold wealth was expended on these works in bronze, copper, iron, gold, and silver. Of these, some were cast, some were hammered.

Cast iron is not suited for fine work, neither taking very minute impression of lines, nor capable of being worked into such delicate tracery as wrought iron, copper, and brass. Cast iron also requires to be so proportioned that the relative masses of adjacent portions shall not be very dissimilar, else shrinkage stresses will be set up that are apt to cause fracture. Cast iron cannot be made of such extreme tenuity as wrought metal and brass. For these reasons, though it answers many of the purposes of the engineer most admirably, it was not used to any extent worth naming, scarcely at all, in fact, by the mediæval workman. The common use of cast iron as a structural material only dates from the sixteenth century, when the process of smelting by pit coal instead of by charcoal was introduced.

The greatest refinement in the art of casting in bronze appears to have been attained by the great Italian artists. The method, as described by the Florentine artist Cellini, is as follows:—The figure was first roughly modelled in clay to a size very slightly smaller than the casting. Over this was laid a skin or thickness of wax, representing the thickness of the intended casting. A moulder will recognise in this the counterpart of the "thickness" on a loam pattern. The perfect figure of the cast was imparted to this wax with modelling tools, all the fine lines, expressions, etc., so perfect, as to leave little for after touching-up. Then a mixture composed of clay, pounded brick, and fine ashes, made with water to the consistence of cream, was applied with a brush, completely filling every interstice, and afterwards this was enclosed in a substantial body of clay, and the whole banded with iron hoops. Then the mass was baked in an oven, and the wax melted and escaped through holes left for the purpose. Rods of bronze passing from the outer mass to the inner core maintained the thickness of the interspace left by the melted wax constant, and into this space the metal was poured. After the removal of the baked clay the casting only required touching up.

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But much of the old metal work was hammered as we now do repoussé work. The sheet metal was laid upon a bed of cement, composed of pitch and pounded brick, and the design was beaten into relief with hammers and punches, the pitch yielding, and so preventing fracture of the metal, however great its tenuity. This method was practised by the Assyrians and Greeks, as well as by the mediæval artists. The gates of Shalmaneser II. date from 859—824 B.C., and the Siris bronzes by Greek artists, both of which are in the British Museum, and are fine examples of repoussé work. In the latter the heads of the figures, though standing out life-like, and little thicker than paper, have been nowhere broken by the punch.

The great candelabrum in Milan Cathedral is a wonderful work of art, and dates from the twelfth century. It is fourteen feet high, has seven branches, and is supported on four winged dragons. Even the minutest details of this work are finished with all the care that can be bestowed on the most delicate bit of jewellery. There is a plaster cast of this at South Kensington.

In the thirteenth and fourteenth centuries wrought iron came into general use for screens for chapels and tombs, and grilles for windows. It is impossible in this paper to so much as mention the greatest works of this character. Florence is rich in these precious antiquities, true works of art in which the skill of the smith is made to embody the creation of the artist, in which the boldest design and the most delicate imitations of nature harmonise, works which have been the wonder and despair of succeeding generations. The Italian smiths were famous for their skill, so too were the English, and specimens of their handiwork are to be seen at South Kensington.

Even the hinges of the doors which remain from mediæval times are true works of art and craftsmanship. The earliest English hinges date from about the tenth century, soon after the Conquest. They are stiff and cramped. Specimens occur on the west door of Woking Church, and at Compton, Berks. But in the Early English style they become very much elaborated and ornamented. The hinges on the refectory door of Merton College, Oxford, date from the fourteenth century.

Other specimens of door hinges occur at Radford Abbey, at Nottingham, Butleigh Church, in Somerset, Rouen Cathedral, St. George's Chapel, in Windsor, the doors of the Chapter House, York Minster, the south door of Durham Cathedral, and other localities.

In all the mediæval works, whether hinges, screens, gates, or cathedrals, there is the same grandeur of conception and beauty and perfection of execution, which inspire us with astonishment, reverence, and delight.

We marvel much at the many-sidedness of the old artists and the mediæval craftsmen. We wonder that men could master so much and so thoroughly like Leonardo da Vinci, mechanician, engineer, sculptor, artist, and man of science; Michael Angelo, painter, sculptor, architect; Quentin Matsys, blacksmith and artist, and others whose names will occur to the mind; and we attribute it to the small extent of ground which was covered by any single art or science in those periods as compared with the present. But this is not by any means the whole of the truth. If we have gathered a greater array of facts and details, the men of those times had grasped the broad ideal, underlying and encircling the practice of their craft, and they were not slaves to a little section of the same. Trades were not divided into sections, each man making the fractional part of a pin, of a garment, or of a machine, as is the case with us. The present division of labour, so profitable as a money-making system, so ruinous and depressing to the individual, did not then exist.

Those who have given attention to the history of the craft guilds of the Middle Ages are not at a loss to understand why the artisans of that period reached so high a degree of excellence in workmanship. As voluntary associations of brotherhood for mutual interest and protection, these guilds date under various aspects from early Anglo-Saxon times, probably even earlier. (The Blacksmiths' Company was incorporated in 1325.) They were strengthened by the most powerful sanctions of morality and religion, and solemn rite and ceremony. In the periods of their supremacy, every craftsman was compelled to belong to his proper guild, which exercised the most despotic power, usually for good, over him. No person was admitted a member who had not served a regular apprenticeship, the admission of whom was generally done in a solemn manner either at the Town Hall or at the guild meeting. The apprentice formed a portion of the family of his master, who was compelled to teach him his craft, and was held responsible for his morals. The regulations of the guilds were such that neither inferior materials nor bad work was permitted. As yet there was no division into capitalists and workmen, for most craftsmen shortly became masters and took apprentices. The guild statutes before the fourteenth century do not even mention the workmen, and it is not till about the middle of that century that regulations concerning them, as distinguished from their masters, were necessary.

Nor must we forget the influence of religion on the mediæval craftsmen. The Church was the principal patron of the arts and handicrafts. The great cathedrals and churches, with their altars and tombs, absorbed the best work of their time. Wealth there was in abundance to pay for the labour of years, whether that labour was engaged with the body of the building itself or on its adornments. The Church was the supreme power in society, overshadowing and overawing the kings and ministers, the warriors and the burgesses. The guilds, too, had their patron saints; they set up painted windows, erected altars, distributed alms, and went in solemn procession to church. Though such relations are ousted from nineteenth century industrial life, they, nevertheless, were a most vital factor in the mediæval period.

(*To be continued.*)

PANELS FOR WOOD CARVING.

BY FRED MILLER.

(*Continued from page* 145.)

The Plum, the Blackberry, and the Wild Rose.

All craftsmen should desire to design their own work, for it is not only more interesting to carry out the ideas that have emanated from one's own brain, but there is every likelihood that the work itself will be more spirited if the hand of the cunning worker is used to express his own ideas. I cannot do better, therefore, than offer a few suggestions on "designing for wood carving."

The three designs that accompany this paper are based on familiar forms, the larger panel (Fig. 1) showing the plum, and the smaller panels (Figs. 2 and 3) the common bramble or blackberry and the wild rose. I have purposely chosen familiar plants, because I want my readers to go to nature for themselves, and get the inspiration that is always to be derived from a study of nature direct from the fountain head. Every craftsman should make a point of drawing plant form whenever he has an opportunity, for all design is based on an intelligent study of plants. Draw any plant rather than none, but exercise your faculty of selection, and study particularly those plants which are what designers term "ornamentally suggestive," for a form like the bramble is full of suggestion, almost all its features giving the craftsman "opportunities." The leaf itself, made up of five small leaves growing from a common stalk, is most adaptable, and can be rendered effectively in wood. Then the way the leaves articulate from the stem in what is termed a "whorl," or around the stem on the principle of a spiral, is a point to be noticed. The stem, again, with the spines is an ornamental feature, and one that can be, and should be, made much of. In the panel it will be noticed that I have introduced a flower and buds as well as fruit, in order to enforce practically the axiom that every suggestion should be made the most of by the craftsman, and as the flower is seen at the same time as the fruit, such a trait should be utilised and insisted upon. The fruit, again, with it numerous little beads or "drupes," is most effective in carving, as the surface being broken up, catches the light, and casts numerous shadows, which give brilliancy and relief to work, and prevent any tendency to tameness.

The skill in wood carving is seen in the way the surface is broken up or "thrown about," as carvers say. In other words, it depends for its effect on some forms being prominent and receiving light and others being kept back and producing shadows. The throwing about can less easily be studied in a sketch than in modelling in clay, for one is more occupied in disposing the various forms, filling out the space, and arranging "lines" than in studying it as a piece of carving. I have endeavoured to suggest by light and shade which parts should be prominent and which should be kept back, but in actually carrying out the design many modifications would doubtless present themselves. Many wood carvers model the design roughly in clay, and work from this rather than from the design on paper, and undoubtedly a more accurate estimate of the finished work can be thus obtained than by the most elaborate of pencilled drawings. But this is a branch of the subject which must be treated on another occasion.

To return to the designing. To make the best use of plant form, it is necessary to draw the plant many times, until one is thoroughly imbued with its spirit and knows all its salient features by heart. For in designing you do not want to think of any one particular specimen you have on some occasion seen, but your object is to put into your design the characteristics of the plant, and not the adventitious and individual peculiarities of some *one* specimen. And to get freedom as a designer one must be able to depend largely upon recollection (the stores of a well-stocked memory accumulated by patient and thoughtful observation), rather than upon reference to fragments. The planning and disposition of the main lines of the design should, at

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all events, be studied apart from any individual specimens; for if one has recourse to such data, the design is apt to be local and petty instead of general and dignified. In other words, the letter instead of the spirit will be found in your work when the recollection is not largely depended upon.

A designer has to first of all dispose his forms so that they occupy the space without crowding it, and the skeleton of the design should have balance, proportion, and grace—qualities which largely

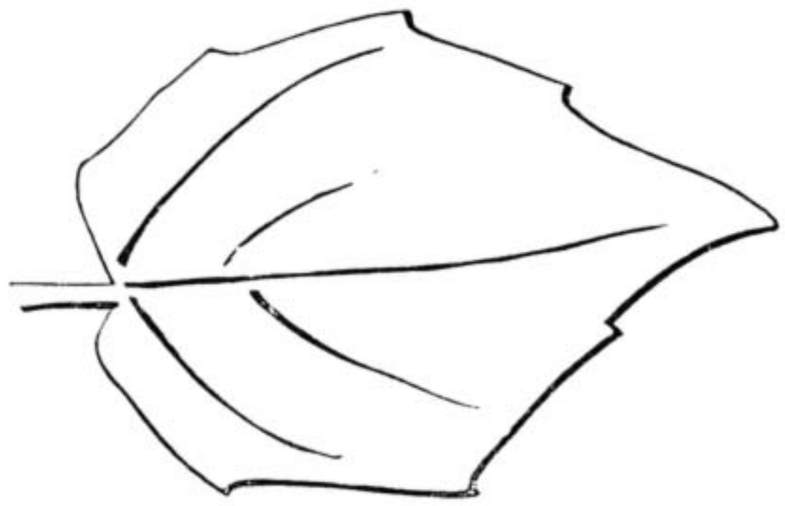
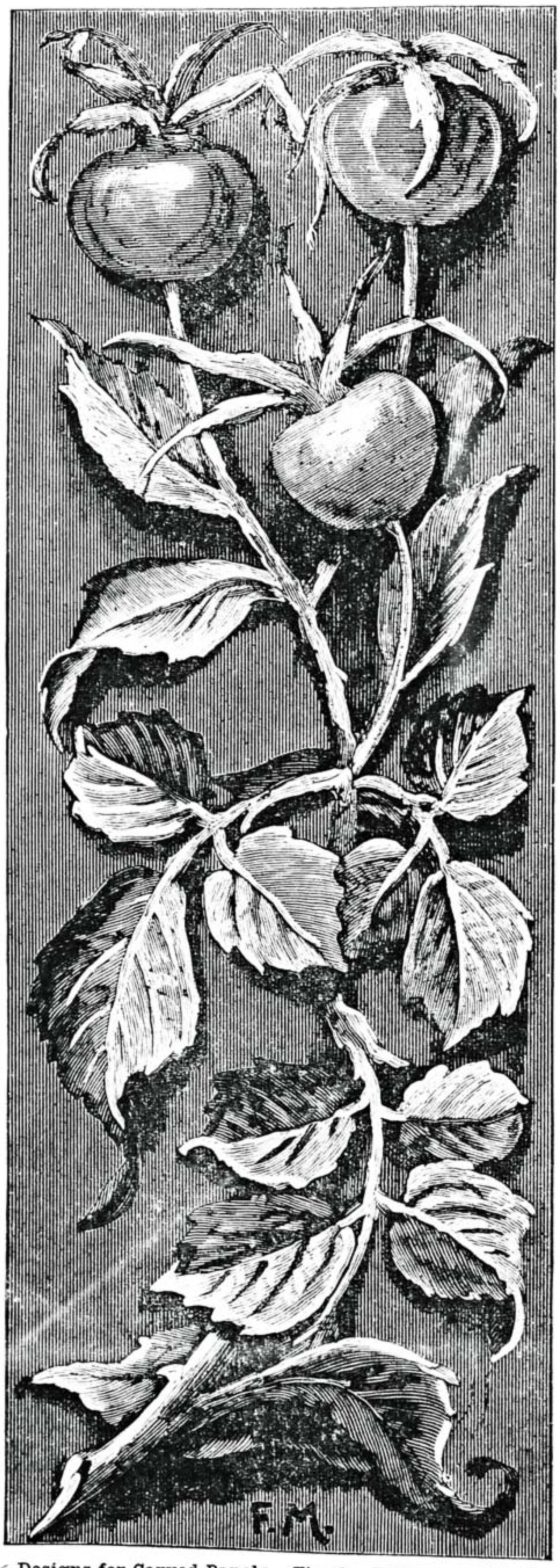


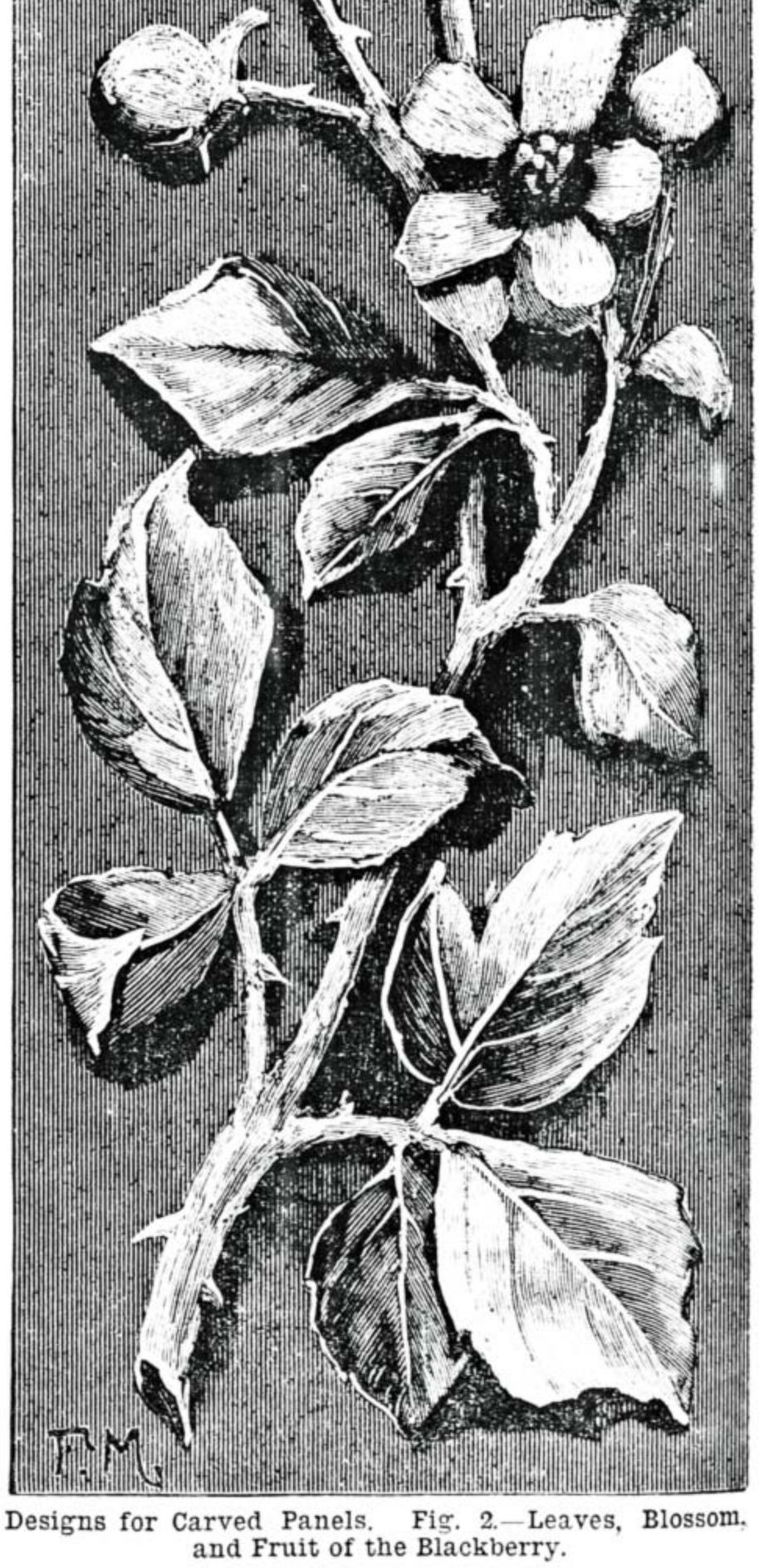
Fig. 4.—Angularity in Leaf Form to be followed in Wood Carving.



Designs for Carved Panels. Fig. 3.—Foliage and Fruit (Hips) of the Wild Rose.

reside in the designer's inner consciousness: for you may have made a most excellent drawing of a bramble, and yet utterly fail to adapt a portion of it to occupying a particular space agreeably, or in such a way as shall give the beholder the feeling that the bramble filling out the panel was designed for that space, and that alone, and could not have been employed elsewhere.

Then the capabilities of your material and the possibilities of your craft have to be considered. Remember always that you are not, as a wax modeller does, imitating a piece of bramble in wood, but are carving a *design* suggested by the bramble. A great deal must perforce be generalised, for if we think a moment it is evident we cannot cut all the stamens in the centre of the flowers, or make the spines on the stem as sharp as they are in reality, or put every vein in the leaves. But we can *hint* that the stem is set with excrescences we call thorns, and can suggest that the leaves are veined in one way and not another, and that the stamens are many. We shall be truer by our generalising than we should be if we attempted to reproduce all we know to be there if we look for it, for then we should fail, owing to the impossibility of carrying out such a task, whereas we can entirely succeed if we only attempt to suggest the marked peculiarities or individuality of



Designs for Carved Panels. Fig. 2.—Leaves, Blossom, and Fruit of the Blackberry.

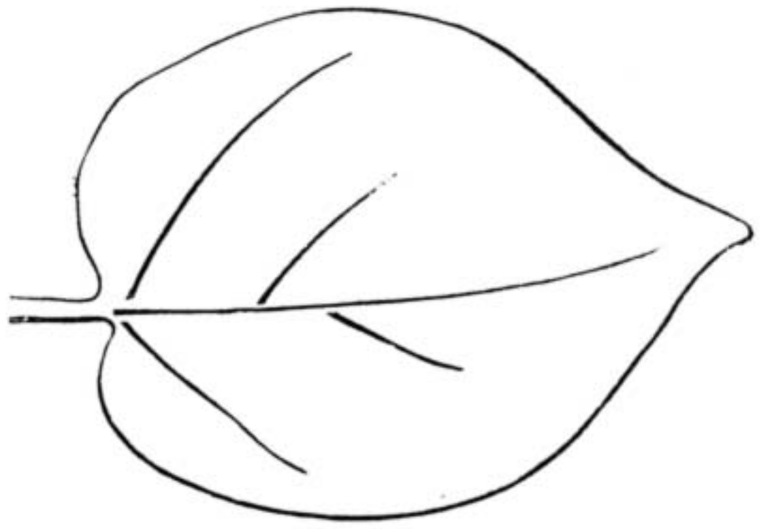


Fig. 5.—Rounded Outline in Leaf Form to be avoided in Wood Carving.

the bramble. We must draw what appears—what strikes the eye when we look intelligently at an object—and not what we know from previous study to be there: and this rule applies with even greater force to the work of the chisel.

Start with the main stems, and get these placed so that they form either agreeable curves or "nervous" angles with each other. At the same time put down your leading features, as the plums in centre panel, for the objects being

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prominent must be thoughtfully arranged so that they do not (*a*) all come in one place and leave the rest of the space vacant, and (*b*) fall one under the other in perpendicular lines, but are spread about, so that if we drew lines from one point to another we should make a series of triangles instead of squares. Having roughly fixed upon the position of stems and fruit, we can now think of the leaves. These want most carefully arranging, and many considerations step in. We must not have too many leaves — not nearly as many, in fact, as we might find on a piece of plum, for we want to keep our design simple. Then some leaves can fall over the fruit and stems, for the stems should here and there be broken up by leaves or fruit, to take away the look of *stalkiness*. As we proceed with our design we shall modify some of the features already indicated, for second thoughts are often the better. It stands to reason that as all forms have a relation to each other, the introduction of a leaf or fruit may cause us to slightly modify the disposition of some particular piece of stem, though adhering generally to our first suggestion. Thus you see a design is gradually built up or put to pieces like a puzzle, and not set down as a whole, complete in all its details from the outset.

Designs for Carved Panels. Fig. 1.—Plum.

In carrying out the three designs, an enlarged drawing should be made the size you intend to carve them — say three times larger than their dimensions in WORK, or fully the natural size. The enlargement should then be transferred to the wood, or pasted down upon it if you do not require the design again. The depth of the "grounding out" (taking out the background) depends upon the thickness of your wood; but I would advise those workers who are still novices not to attempt too much relief. Keep the design as a low relief, for the carving or "throwing about" is *the* difficult part of the work, and the more relief you attempt so are your difficulties increased. I should be disposed to try the designs not more than half an inch in depth; even three-eighths would be sufficient. The "grounding out" is much more difficult the deeper it is taken into the wood, and at the outset the general difficulties are quite enough to overcome, without courting others. It is much better, I hold, to succeed in a humble way than egregiously fail by over ambition; and I always make a point whenever I have taught to put a very moderate programme before my pupil, and direct my assistance to enabling him to overcome such difficulties as arise, so that succeeding with a moderately simple piece of work, he is emboldened and encouraged to go from more to more.

My remarks, as well as the designs themselves, are intended for those who have had some practice in wood carving; but in another number of WORK I will take the reader back to preliminaries, and begin *de novo*.

One word more. I spoke just now of the stems making *nervous* angles with each other. A design is said to be "nervous" when there is vigour, crispness, angularity in it — qualities, in short, the reverse of tameness. Now, getting the work *angular* is what gives work its nervous quality. Instead of the edges of leaves being round or continuous, they should be in a series of angles (as in Fig. 4), and not rounded (as in Fig. 5). Examine leaves for yourself, and you will notice that nature is full of angles. The leaves break vigorously from the stems, and the stems again form most beautiful angles with each other. "Round" lines are always a sign of want of skill, and are sure to produce a feeling of insipidity and feebleness. Do not be afraid of letting your chisel show itself in your work. Good wood carving looks as though the craftsman had executed his work by a series of well-directed bold cuts rather than a number of nerveless timid ones.

I see that I have mentioned the need of an enlarged drawing if you wish to reproduce the designs on a larger scale than that in which they are given in the engravings, but I have said nothing about the method to be followed in enlarging, which some readers possibly may not know. Suppose you wish to produce a copy of Fig. 3 *twice* its size (that is to say in linear dimensions, for the area covered will be *four* times the area of the original), divide the drawing into squares ½ inch each way by drawing lines across it and from top to bottom at intervals of ½ inch. Then rule a piece of paper in the same way with lines one inch apart, and having done this copy the outline, square for square, on the paper thus prepared. You will thus get a true and exact enlargement.

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ARMATURES AND ASSAYING.

BY GEORGE EDWINSON BONNEY.

AQUA REGIA—ARMATURE—ARSENIC—ARSENIOUS ACID—ASSAY: ASSAYING—ASSAYING FOR GOLD BY THE DRY WAY.

Aqua Regia.—A mixture of nitric and hydrochloric acid has long been known by this name. This also is a compound of two Latin words meaning "royal water." The name was probably derived from its well-known property of being able to dissolve gold, the royal metal. The usual mixture of the two acids employed to dissolve gold is composed of hydrochloric acid three parts by measure, to nitric acid one part by measure. The both acids should be pure, and only mixed just before they are required, as the mixture will not keep good for any length of time. Even when enclosed in a glass-stoppered bottle it is liable to be decomposed and cause a separation of chlorine from the other constituents. A druggist related to me a short time ago a little experience of his illustrative of this property. A careless assistant mixed some aqua regia, put it in a glass-stoppered bottle, tied the stopper down to prevent any escape of chlorine, and placed the bottle, with other drugs, near the shop window. Shortly afterwards the sun shone strongly on that window, and then there was an explosion, which not only shattered the aqua regia bottle, but also several other bottles around it, and filled the shop with suffocating fumes. Aqua regia will dissolve platinum, but more slowly than it dissolves gold. On some other metals it acts more strongly than any single acid, but on silver it has scarcely any action, owing to formation of the insoluble chloride of silver which forms a crust on the metal, and protects it from further action.

Armature.—A name given to the iron keeper of a permanent magnet. It is also applied to that part of a dynamo-electric machine which is rotated within the influence of the field magnets. In the greater number of those machines, the armature is made to revolve within the field, or magnetic influence of the magnets, but there are some exceptions in which the magnets are caused to revolve and the armature is stationary. Revolving armatures and fixed field magnets have the merit of adding stability to the machine and steadiness to its running and the output of the current. Each inventor of a new dynamo-electric machine appears to have adopted a special form of armature, hence we have as many forms of armature as there are inventors of machines. The armatures of dynamo-electric machines are generally furnished with iron cores, around which the insulated copper wires are wound. Machines have been constructed without iron cores by Messrs. Siemens, Ferranti, & Thompson. In those machines a looped or zigzag band of copper is attached to a brass spider, mounted on a spindle, and forms the armature Armatures are divided by Sir W. Thompson into four types:—

"(1) *Ring armatures*, in which the coils are grouped upon a ring whose principal axis of symmetry is its axis of rotation also.

"(2) *Drum armatures*, in which the coils are wound longitudinally over the surface of a drum or cylinder.

"(3) *Pole armatures*, having coils wound on separate poles projecting radially all round the periphery of a disc or central hub.

"(4) *Disc armatures*, in which the coils are flattened against a disc."

Of these it is as well to say that examples of the first type are furnished by the machines of Gramme, Schuckert, Gülcher, and Brush. Examples of the second type are found in the Siemens (Alteneck), Edison, Weston, and Elphinstone-Vincent machines. Examples of the third type may be seen in the dynamos of Allan, Elmore, and Lontin. There are few useful examples of the fourth type, but several combine the first with this, as where flat rings, or discs, are used side by side. When solid iron is employed for an armature core, it abstracts a portion of the electric current from the machine, and this is employed in heating the iron. The current thus abstracted, forms what is called eddy currents in the iron, and causes the machine to become hot. Iron armatures should, therefore, be built up of thin sheet iron discs, or plates, or hoop iron, each piece of iron being insulated from its neighbour by varnished paper or calico. The armature coils should be of pure copper wire, well insulated with cotton steeped in paraffin, and the wires should be as short and thick as is consistent with the requisite E.M.F. without driving the machine at an excessive rate of speed. For further information, see notes on *Dynamos*, *Electric Machines*, etc.

Arsenic.—Chemical Symbol, As. A crystalline and very brittle metal of a steel-grey colour and high metallic lustre which readily tarnishes in the air. It is found combined with sulphur in the ores of several metals, and as an arsenide with iron, nickel, and cobalt. When these ores are roasted, the arsenic in them combines with oxygen, and forms crude arsenious acid. This is purified by sublimation, and roasted with charcoal in a retort where the arsenic is reduced to its metallic state. The combining or atomic weight of arsenic is 75. It readily combines with oxygen on being heated, and is converted into arsenious acid. Heated in a retort, it volatilises without fusion. Arsenic may be made to combine with metals, and the alloy thus formed bears a close resemblance to that of an alloy of the same metal with phosphorus. The general effect of its presence in a metal is to increase its hardness and lessen its conductivity. Impure copper is sometimes contaminated with arsenic.

Arsenious acid, named also *white arsenic*, and *white oxide of arsenic.*—Chemical symbol, $As_2 O_3$. Molecular weight 197·8. This is the only compound of arsenic used by the electro-plater. Professor Fownes says of it:—"It is a heavy, white, glassy-looking substance. When freshly prepared it is often transparent, but by keeping becomes opaque, at the same time slightly diminishing in density, and acquiring a greater degree of solubility in water." Boiling water will dissolve arsenious acid in the proportion of 11·5 parts acid to 100 parts of water, but 8·5 parts of the acid is thrown down when the solution cools. Agitated in cold water, even less acid is dissolved. These solutions will redden litmus paper. Alkaline solutions dissolve it freely, forming arsenides with the alkali. It is easily soluble in hot hydrochloric acid. The vapour of the acid is colourless and inodorous. "The acid has a feeble, sweetish, and astringent flavour, and *is a most fearful poison.*"

A solution of arsenious acid in water may be easily detected by the following methods:—

1. Add a solution of silver nitrate. At first there will be no precipitate, or merely a slight cloudiness in the solution. On adding a little alkaline solution or a drop of liquor ammonia, a yellow precipitate of arsenide of silver will be formed. This precipitate is soluble in an excess of ammonia, and also in nitric acid.

2. Add a solution of sulphate of copper. This gives no precipitate until a little alkali is added, when a yellow-green precipitate (Scheele's green) is formed. This is also soluble in excess of ammonia.

3. A slip of copper foil boiled in the liquid suspected to contain arsenic, will become whitened if the liquid has been previously acidulated with hydrochloric acid.

There is no simple antidote for arsenical poisoning, but calcined magnesia mixed with water will give relief. Death may be averted by the timely use of the stomach pump, and remedial agents prescribed by a competent medical man. See also notes on *Poisons, and Poisoning.*

Assay: Assaying.—An analysis of metals, notably those denominated precious metals, with a view to determine their purity. The apparatus necessary to conduct assaying operations is too costly to be within the reach of electro-platers working in a small way of business. But all large firms engaged in the manufacture of goods in which large quantities of gold and silver are used, should have means at hand for assaying the goods. Only a mere outline of the process can be given here. Full information can be obtained in Mitchell's "Manual of Assaying." Assaying for gold and silver is performed in the dry way by the use of suitable furnaces and crucibles, or in the wet way by the use of acids and certain chemical re-agents.

Assaying for Gold by the dry way.—First of all weigh out a sample of the metal to be assayed in a delicate balance capable of indicating to 100th of a grain. The sample should be some easily divisible part of the pound troy or the pound avoirdupois, just as the answer may be required, or it may be some aliquot part of 100 grains. If it is suspected to contain more than one-fourth of its weight of gold, it must be fused with enough silver or copper to bring the proportions to exactly 1 part gold to 3 parts alloy. The bead of metal thus obtained must now be flattened out to a thin disc, or rolled to a thin riband and annealed. It is then placed in a thin glass flask, or beaker, or in a porcelain capsule, together with 2 parts pure nitric acid to 1 part of distilled water, and heated over a sand bath until all ebullition has ceased and the hot liquid ceases to give off bubbles of orange-coloured nitrous oxide. The acid solution of copper and silver must then be poured off into another beaker, and the finely divided gold dust or sponge of gold well washed with distilled water ejected from a wash bottle. Finally, the gold must be washed into a small porcelain crucible or into a cornet pot, dried, and fused to cause coherence of its particles. It may then be accurately weighed, and the proportion of gold calculated.

It is not possible for me to complete my Notes on Assaying in this number, and I must therefore postpone to the next paper the further consideration of gold and silver assays in the dry way, as well as the assays or analysis of metals that are known to contain silver. The subject is one of considerable importance as well as interest, and therefore deserves and demands attention. I shall not detain the reader long with this subject, and I shall then pass on rapidly to other topics which have been kept waiting through sheer inability to give greater instalments at a time.

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OUR GUIDE TO GOOD THINGS.

47.—Steel Calliper Gauge.

In Fig. 1 in this page is shown, full size, a very handy little instrument for machinists and tool makers, manufactured by Mr. Chesterman, of Sheffield, and sold by all dealers in tools and hardware merchants throughout the United Kingdom. Beautifully made, accurately divided, and exquisitely finished, it demands the attention, and should be in the possession, of every workman of the trades for which it is chiefly intended. The Steel Calliper Gauge is made in four varieties, distinguished by the divisions marked on them, each variety being made 3 in., 4 in., and 6 in. in length. The four sorts are known by numbers stamped on the instruments to facilitate distinction, the numbers being 1400, 1401, 1402, and 1403. They are sold, the 3 in. at 5s., the 4 in. at 5s. 6d., and the 6 in. at 6s., in all varieties except No. 1401, the prices of whose three sizes are 6s., 6s. 6d., and 7s. respectively. It will be useful to say that No. 1400, as shown in the illustration, is divided, the inches into 32nds, and centimetres into millimetres and halves. In 1401 the metric divisions are the same, but inches are subdivided into 32nds, 48ths, and 50ths. In 1403, divided for inches only, the subdivisions are into 32nds and 50ths. No. 1402 differs from the rest, in having inches and circumference measure shown upon it, of which the former is divided into 32nds and the latter into 16ths. The particular use of this gauge is that if the diameter be known and the movable arm adjusted thereto, the upper end of the arm will also indicate the circumference in inches, and *vice versâ;* if the circumference be known the diameter may be read off the scale by adjustment of the movable arm. The construction of the instruments may be seen from the illustration. A flat steel bar, which is carefully graduated, is set on the fixed arm of the Calliper Gauge at right angles to it. On the bar slides the movable leg, kept in position by a projecting arm at the bottom and a spring at the top. At the top there is always a binding screw by which the movable arm may be held in place and rendered as rigid as the other.

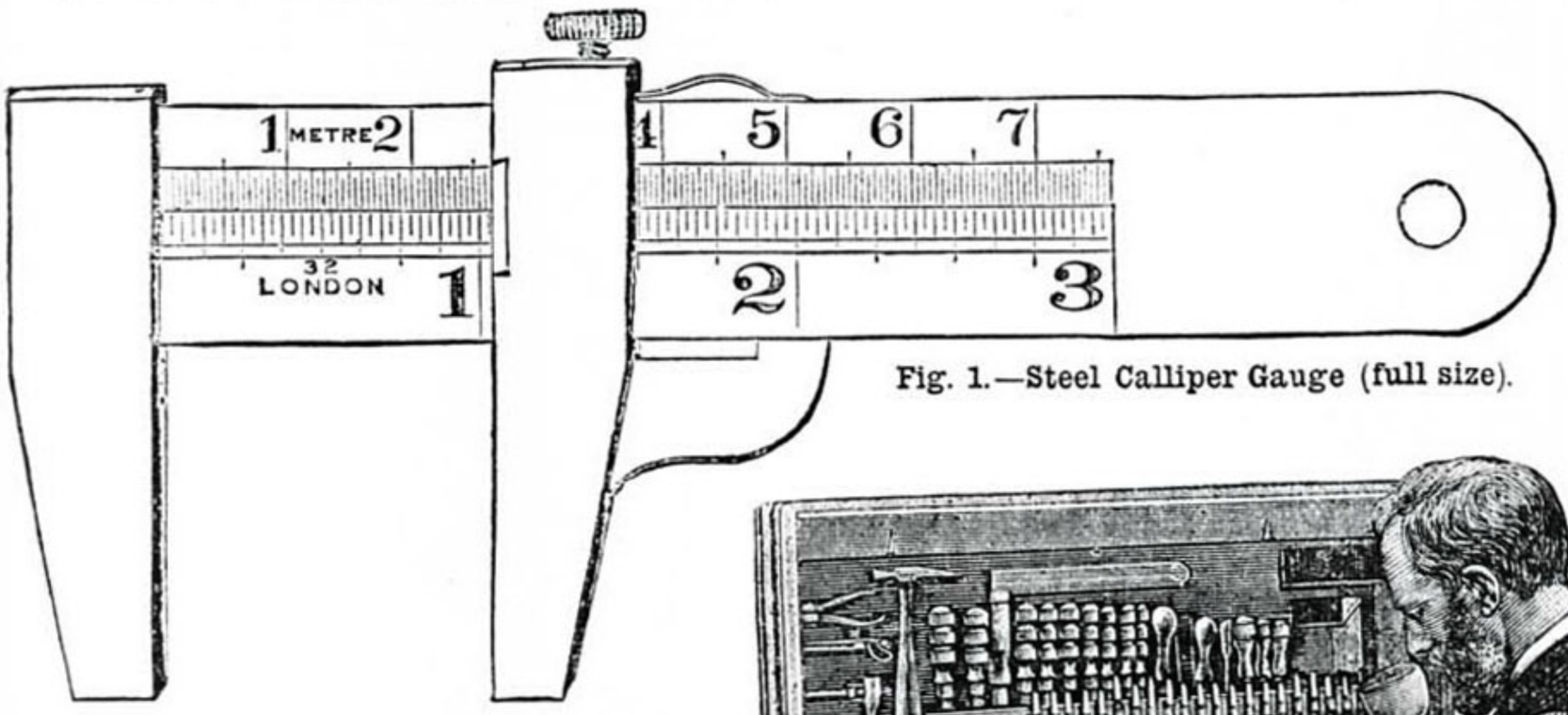

Fig. 1.—Steel Calliper Gauge (full size).

48.—Barrett's Improved Combination Roller Gauge.

This capital tool is an importation from the United States, in which it was patented barely a year ago. It is manufactured by Mr. C. E. Jennings, 79 and 81, Reade Street, New York, the maker of the well-known Jennings' Twist Bits. Its nature may be seen from the illustration of it given in Fig. 2, which is just half size. It consists of three parts, and is composed entirely of metal, the head being of superior grey iron, and the beams of Bessemer steel finely polished and nickel-plated throughout. The head is octagonal at top, as shown in Fig. 3, and circular below. It is pierced with two holes in which the beams work, the latter being secured, when adjusted, by binding screws, which appear clearly enough in Fig. 2. The larger beam is 8 in. long, and is graduated throughout its length in inches and 32nds of an inch. The smaller beam is 4 in. long. In place of a spur or point, rolls of the finest steel are used, bevelled to a fine edge, hardened and revolving on the shank of hardened steel screws, enabling them to run over cross-grain, knots, and rough surfaces with perfect ease and accuracy, making a nicely-finished, easy, and perfect working tool. It may be used both as a mortise gauge and as a marking gauge, but when it is used in the latter capacity the head or roller of the shorter beam must be dropped into the recess made for its reception in the plate, and shown to the right in Fig. 4. It is a nice tool to handle, and much superior to the ordinary wood gauges. It is only recently on the market in this country yet, and its price is 9s. 6d. post free.

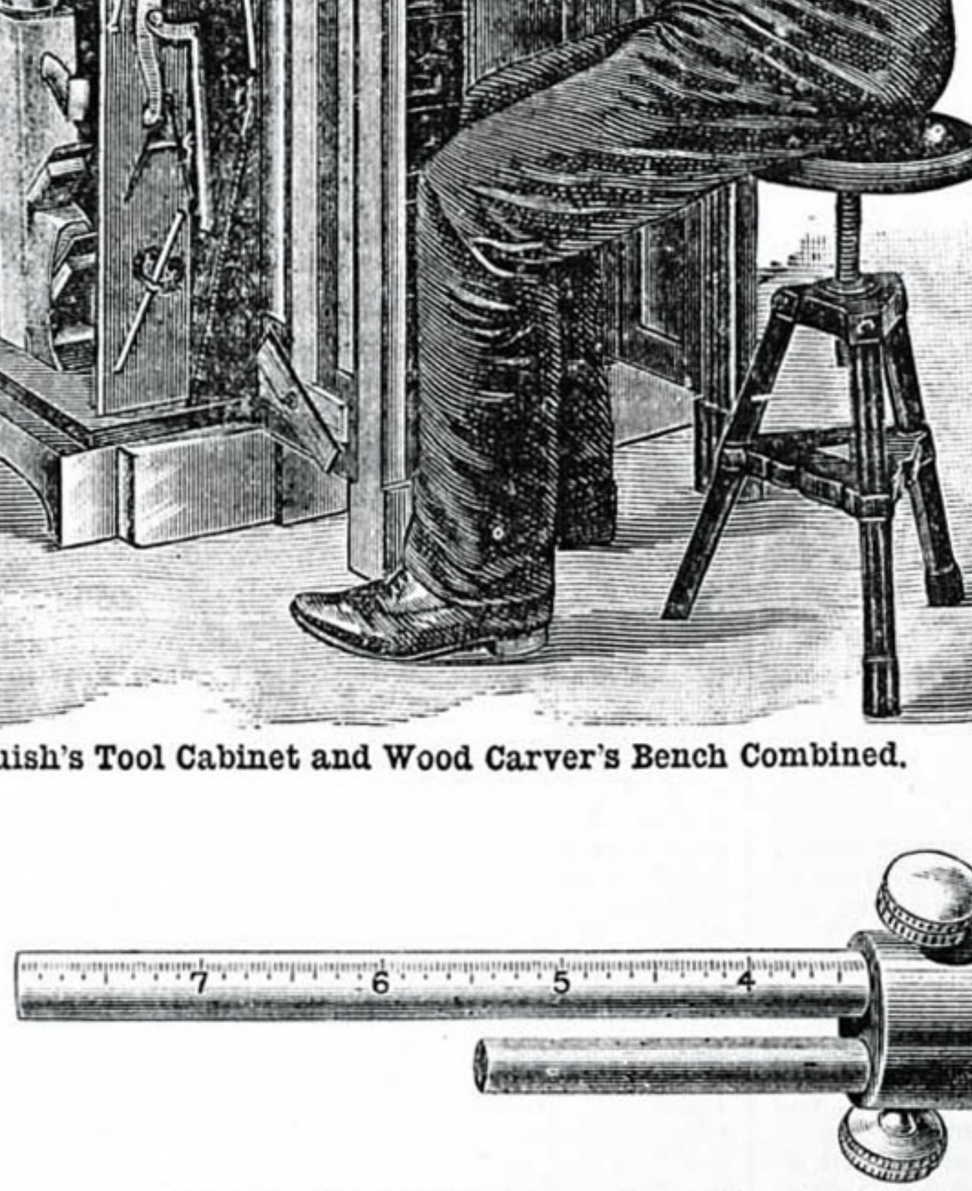

Fig. 2.—Barrett's Improved Combination Roller Gauge (half size).

49.—Patent Combination Tool: Joinery and Carving Work-Bench Cabinet.

In No. 6 I drew attention to this Cabinet in its primary form, and alluded to certain modifications which were about to be made in it by the inventors and patentees, Messrs. R. Melhuish and Sons, 85 and 87, Fetter Lane, E.C. The Cabinet may now be had in its alternative form, as represented in the illustration given in Fig. 4, fitted with tools complete, for £25 8s. The alterations and improvements effected are these. The lower drawers, which came to the front in the first form, have been reduced in width and recessed, giving more space for the workman when standing in front of the bench at work. The front of each side of the Cabinet opens outwards on hinges as shown, travelling on surface rollers under bearers, thus by direct bearing forming a solid and perfectly rigid support for an addition to the work bench in the form of a stout, well-made board, which is attached to the longer part of the bench by dowels. To this the supports are bolted by flush bolts of peculiar arrangement, which, being fixed by springs, remain unmovable, and are free entirely from the vibration which would be caused in ordinary bolts by percussion occasioned by the use of hammer or mallet on the bench above. This carving board, as it is called, when not in use, is stored away in a recess shown in the engraving, just under the joiner's vice, which it fills to a nicety, its width and length corresponding to the depth and height of the Cabinet. It can be utilised for carving, as shown by the operator at work, who is represented seated on a convenient revolving stool resembling a music stool, but of stronger make, whose height may be regulated at pleasure. In the carving board are two holes, bushed and surrounded with plates flush with the bench. In these, nicely made holdfasts may be inserted to hold work in process of carving. These holes are further utilised for the reception of a brass stand for a drawing board, which may be inserted in either hole and moved in any direction, thus giving facilities for drawing, painting, and reading, by using the board as a reading stand. The transition of the drawing board from a horizontal to a vertical position, or any angle between, is effected by a rack and pinion attached to the T plate screwed to the under surface of the drawing board, and actuated by a large milled head attached to the rack. It is difficult to imagine a more convenient piece of furniture for an all-round man who likes to use tools of all kinds, pen and brush alike, but is somewhat limited for space for the using. The drawing board is stored when not in use in a recess contrived for its reception at the back of the Cabinet, entered from the right-hand side.

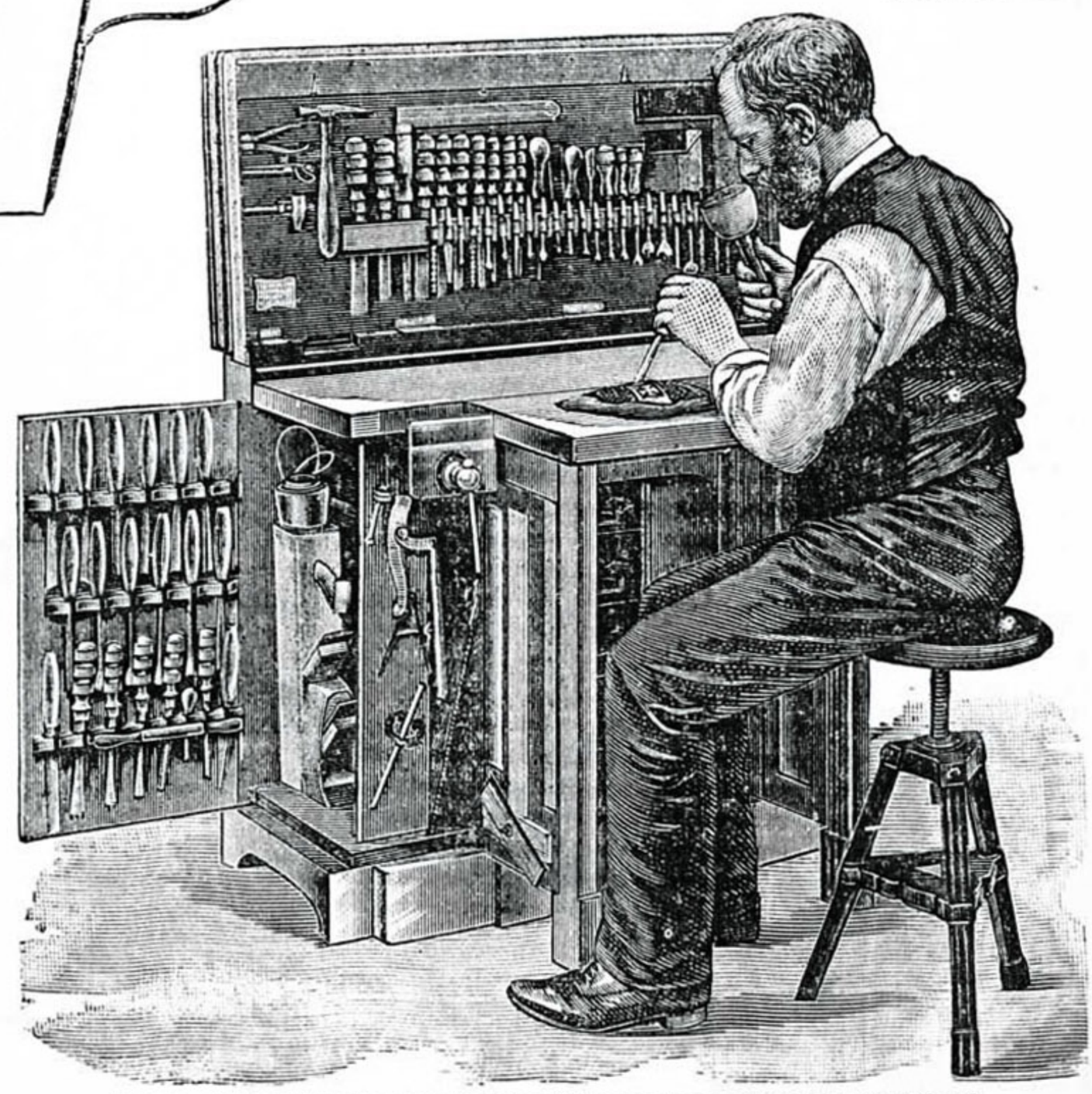

Fig. 4.—Melhuish's Tool Cabinet and Wood Carver's Bench Combined.

Fig. 3.—Plan of ditto seen from above (half size).

THE EDITOR.

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SHOP:

A Corner for Those who Want to Talk It.

*** *All Communications will be acknowledged, but Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Circular Saws Running out of Truth.—A. R. (*Scorrier*) writes:—(1) "In perusing the pages of Work from time to time, I hope to derive some benefit from queries answered and letters written by practical workmen, who are kindly invited by the Editor to give such information relating to their trade as may be in their power to give. And as we live by each other, I think it is the duty of all readers of Work to do what they can to instruct their fellow readers, and at the same time be the means of helping to make Work a most interesting and valuable paper. Therefore, the few remarks I may make on circular saws I hope will be of benefit to those interested in the same, and any question asked through 'Shop' on saws for general work I shall be pleased to answer to the best of my ability. There are many reasons why circular saws deviate from a true path; I will endeavour to give some of the principal reasons. First there should be plenty of power to drive the saw or saws a regular speed; if power is limited, the saw will be merely dragged through the timber, and not driven through as it should be, consequently the saw soon gets dull and requires sharpening often; if worked dull saw plate will be strained or buckled, and it will commence to run out of truth. (2) In driving saws from 24 in. diameter and upward, the distance between centres should not be less than 16 ft., nor more than 24 ft. or 25 ft.; if the belt is short the tension has to be great, consequently the bearings become hot, the heat is conveyed to the centre of the saw, and it will bulge and run out of truth; if the belt is too long it will sag, and the bearings soon begin to cut, and the same results follow. (3) Belts should not be less in width than one-seventh the diameter of saw, and pulleys on saw spindle not less in diameter than one-third the diameter of saw. (4) A bearing should be near the pulleys on spindle to take the pulley belt, so as to prevent vibration of saw spindle; should it vibrate it will be conveyed to the saw, and undue friction will be set up; after a short time the saw gets buckled, and runs out of truth. (5) Bearings of saw spindle should fit very nice, and end play should be avoided. (6) The collar washers should be slightly concaved, or the saw will bulge or dish, and run out of truth. (7) The saw should be properly packed; the proper packing of a circular saw is of great importance, and various are the opinions of men on this point; but my experience is that if a saw is evenly hammered it should be packed a little warm at the centre, and the warmth decreased toward the rim, where, when running, it should be quite cool; this will allow for the extra friction which will be going on at and near the rim of saw, the speed being much greater than at the centre. (8) All timber, before presented to the saw, should be properly bedded, or made perfectly steady by some means. How often do we see a man with a piece of round, rough timber, as much as he can lift, trying to push it against a circular saw, and quite unable to keep it steady: the man with fear, as he knows there is danger attached to it. He pushes the piece a few inches, and the saw brings up the belt and slips over the pulley. The saw being freed the work is again commenced, and after a while the cut is got through, and the saw will tell it has not been rightly treated, as it knocks about in a fearful manner, and if you should put the back of your fingers against the saw plate you will find it scalding hot; this heat is caused by undue friction set up by the timber not being steady, and as the friction increases the saw runs out of truth, and at last becomes crippled. The rack bench as well is often used for cutting round timber, with nothing to keep it steady but its own weight, and sometimes a little of the ends sawn off, which, in many cases, spoils the timber of certain work; all such timber should be so clamped as to keep it perfectly steady, and it would, to a great extent, prevent saws from getting crippled, and from running out of truth. (9) The speed of the saw is an important point; should the tool be driven too fast it becomes pliant and runs untrue. The following will be found to be a good speed, if saws are of proper gauge, from 8,000 to 9,000 ft. per minute, at the point of saw teeth; and for hard wood generally, such as elm, ash, etc., a speed of about 6,000 ft. at point of saw teeth. Circular saws kept in good order and properly worked will do good work at the above speeds. (10) The saw should not fit light on spindle nor on steady pin; should heat be conveyed to the centre of saw, it will bind on saw spindle, and the saw will run out of truth. (11) How often do we see a circular saw enter a log of timber, and the sawyer go to the other end of the log, and with pinching bar move the log transversely, the other end of the log acting as a lever on the front of the saw; consequently the saw draws thick or thin, as the term is. The cause of the saw drawing is often put to the bad sharpening and irregular setting of the saw. This moving of the timber, after the saw has entered it, should, by all means, be avoided. If the timber is not in position, it should be brought back and freed from the saw before being moved in any direction. (12) Timber deeper than the saw will reach should not be sawn when the saw is buried. It is impossible to see whether the saw is running true or not, and the plank being sawn off cannot be spread as it should be, so as to prevent friction on the saw plate, which is sure to be great near the rim of saw; consequently the saw gets winding, and gives an amount of trouble to the sawyer by running out of truth, also to the man that has to sharpen the saws. (13) The most essential point is the sharpening of the saws. Unless a circular saw is properly sharpened it will soon become crippled and run out of truth; men vary greatly in opinion on the sharpening of saws. I am of opinion that no man is perfect in the work of saw sharpening, especially of circular saws, and I calculate within the past eighteen years I have sharpened more circular saws than any two men in the county in which I live, and feel I am far from perfect, and that a deal of practice is required. There should be a certain angle for each class of work, and only by practice can we know the best angle to give saw teeth to suit the work it has to do. A frame saw may be put into the sharpening machine, and the emery wheel set to a certain angle, so as to give the teeth their proper rake, and if the saw is used only in one class of wood, we will say soft wood generally. The wheel, when once set, will do at the same angle as long as the saw is being worked; but this is not the case with the circular saw, though many so-called saw sharpeners think it will do. When I go into a works, and see a man put, we will say, a saw 50 in. in diameter in the sharpening machine, and set the wheel to a certain angle, afterwards take another saw much less in diameter, and commence with wheel at the same angle, I am at once convinced he is not the right man for the place—that he does not know his work. If the saw teeth are to be sharpened to an angle of 65° to 70°, it is impossible to give the same angle to a saw of 30 in. diameter as one of 50 in. diameter. Keeping the wheel at the same angle in the smaller saw, the teeth would be much more acute, and not at all adapted for the work. The best rake, as far as my experience teaches me, for teeth of circular saws for soft wood, generally, is to an angle of from 70° to 75°, and bevel of front and top of teeth about 65°; and for hard wood, generally, rake 80° to 85° bevel of front, and top of teeth 75° to 80° in cutting very soft wood. The angles may be more acute than the above, but for general work good work can be done at the above angles. Again, the setting of circular saws is of great importance. If the set is too much more power is required; if not enough the saw will not free itself, and will get overheated. A saw 24 in. in diameter for general work, from two to three gauges set, or about the 36th part of an inch, the set to be increased as the diameter of saw is greater; practice alone will teach the amount required. Again, some are in favour of setting circular saws with hammer, and to a sharp angle, such setting gives a rough surface to the work, and more power will be required to drive the saw. For fine surface work I prefer a hand set, and for thick saws one with two handles, setting the teeth a little curved, and gauging every tooth with a gauge made of a thin piece of steel, saws set as above. If saw plate is true, the saw will cut very clean, providing it is perfectly round. Much more might be said on sharpening and working of circular saws, but some of your readers who are not interested in the above may think I am intruding on valuable space. However, I hope many of your readers may be benefited by remarks I have made, and, if adhered to, saws will not require hammering until so reduced in diameter as to require regrinding, after which they will be as good as new if done by a good maker."

Die Chuck.—H. J. N. (*Malvern Wells*) writes:—"I have had your first issue of Work, and I think it a very useful book for amateurs, etc.; they can see the issue of tools, machines, etc., and it also gives good instruction. Your dog chuck which you have illustrated is very useful and simple. I have much pleasure in submitting a method of making a die chuck, and I should be pleased for you to put it into Work, if you think it worth doing so. The method I propose is to get a disc of hard wood, oak, elm, mahogany, or beech, and turn it down in the lathe to about 8 in. diameter. To make it screw firm on the nose of mandrel, it is best to get a piece of iron of suitable size square in shape, and drill it in each corner, and countersink for screws, then let the plate in flush at the back of wood disc, and screw it tight home with four short wood screws, having first tapped it to size of nose; this ought to hold it firmly, if the plate let in be of sufficient thickness to allow three or four good threads being cut. Now, to proceed with the chuck, go to a blacksmith's and get a disc of iron ¼ in. thick and just over 8 in. in diameter cut; the reason for having it a little over the size of wood disc is to allow for it being turned down to same size. Get it drilled, as marked in Fig 1, and countersunk for head of wood, screws to lie flush with surface. Now get two pieces of V-shaped iron about 6 in. long, or if not obtainable get flat, and file carefully up to shape shown in Fig. 2, which is an end view of chuck, showing V irons fastened on. If you have a large-size old square file, put it in the fire and get it to a full red, and put it on the ground to cool. When cool, cut off two pieces the same length and size, and file up clean and smooth; these are to be the dies. If you have fastened V irons on the face plate as they should be, that is, an equal distance apart from the centre of face plate, and parallel to each other, you can file your pieces of old square file to fit. They should fit tight, but also slide between V bars without binding. The shape they should be filed to I have shown at A, Fig. 2. The V-shaped irons should be drilled for screws to fasten them down by; about four screw holes each for wood screws is sufficient. They should be countersunk. You will also have to drill holes in the iron disc for the screws to pass through into the wood. This you can easily do, first getting the irons true on disc as mentioned before, and then mark for drilling. The next thing to do is to get two pieces of iron about 1 in. wide by ¼ in. thick, and file them up to shape shown in Fig. 3. The hole in the centre having been tapped for pins, the two screws in the feet must have corresponding holes in the iron disc, so as to bring the hole with thread exactly in the centre between V irons at each end. These plates, fastened down with screws through feet and through hole in metal disc into the wood, ought to stand a good deal of strain; they should be opposite one another at each end of bars. Now to make the pins to screw through hole in each plate to slide the steel dies, you will want two pieces of iron of suitable length and size the same size; then cut thread on them same size as the thread in plates, and drill

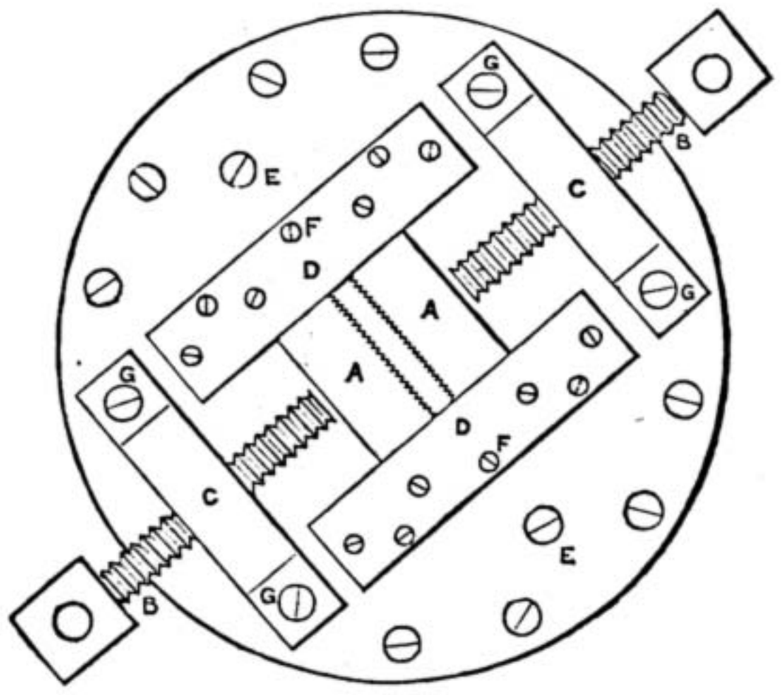

Fig. 1.—Die Chuck, One-fourth Size, Complete.

A, A, Dies in position. B, B, Capstan Screws, Male Threads. C, C, Plates with Female Threads. D, D, V-shaped Bars. E, E, Wood Screws through Iron Disc into Wood: Head countersunk. F, F, Wood Screws through V-shaped Bars and Disc into Wood. G, G, Wood Screws through Screw Plates and Disc into Wood.

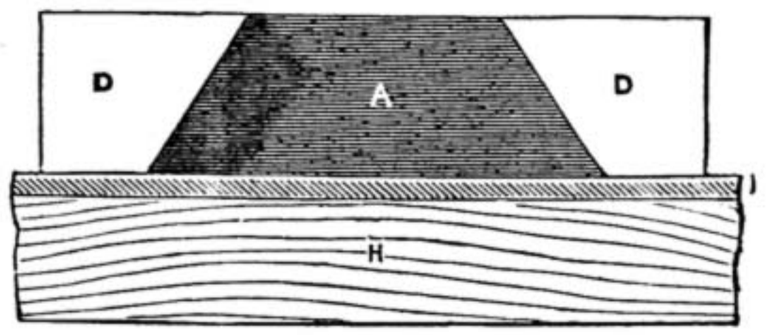

Fig. 2.—View of Chuck Edgeways.

This diagram shows shape of Parallel V Bars (D, D,) for Dies (A) to slide in; also showing Iron (I) and Wood (H) Discs in Section. Not to Scale.

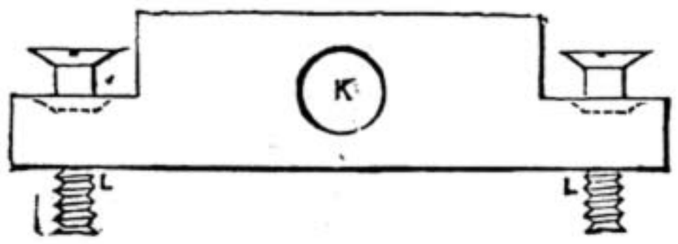

Fig. 3.—Shape of Iron Plates (C, C, in Fig. 1) for Capstan Screws to work through.

K, Threaded Hole for Male Screw. L, L, Wood Screws through ends of Plate and Iron Disc into Wood: Head countersunk.

hole through the end to insert rod, to screw them in and out. Before putting dies in you will want to harden them. The way to do so is to heat them to a full red, and drop them in cold water. If you find them too brittle you can easily let them down by heating a bar of iron red, and placing them on till they take a straw or violet colour, and then drop them into a tin of linseed oil, and let them cool out. The dies should be cut with a three square file along the faces that come next to the work before hardening, or those faces may be left rough when filing up and fitting. As this is optional the maker may please himself. Now put the dies in and screw the plates on at each end, and put a bar between dies and screw up with pins, and you will find that you have a chuck that will hold if proper care and time have been executed, and I hope those who make it will take that trouble, as it will repay them. I have made a few rough drawings of the parts, and, as I have said, if you think it worth putting in Work I shall be pleased for you to do so."

Building Construction.—W. P. (*St. John's Wood*) writes:—"In reply to your request regarding plans and specification, as a consistent reader of Work, if you can see your way clear to assist your readers in this too much neglected study, you will confer a lasting blessing upon a large number, and greatly help others to understand what they need when building."

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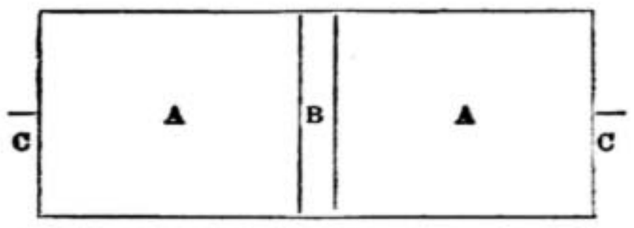
Building Construction.—A. E. D. (*Westcombe Park*) writes:—"Being a subscriber, and feeling greatly interested in the several articles that have appeared in WORK since its commencement, I am sure the proposition of opening out a course of instruction in building construction, as regards modern dwelling houses, would be highly satisfactory for the merits of WORK, and also meet with a great deal of approval by its numerous readers. The foundation you set forth for the treatment of drawings, etc., as a course of assistance to all interested is a remarkably good one—as you say, beginning with the cottager's dwelling, town and country, and so gradually advancing till you get to the more superior villa residences or mansions, which would be valuable information for the educated as well as the uneducated in such matters. I think, as an inducement to secure the co-operation of the readers generally, and so receive a fuller outcome of what we want, it would be well to introduce prize competitions, say, once a month; it would, I am sure, create a closer tie between the practical as well as the theoretical, and be an inducement to maintain WORK as a useful paper in the building trade, where it is, no doubt, having an increased circulation. I conclude with best wishes for your highly valuable paper."

Portfolio for Weekly Numbers of WORK.—SCOTO-IRISH writes:—"Will you allow me to give a suggestion for the preservation of the weekly numbers of WORK, or any other weekly publication? I do not like to see my literature soiled, particularly if I wish to bind it in volumes. So I got a straw board—strong paste or millboard will do better—I cut board in two, slightly larger than a page of WORK, then glued a strip of cloth on boards, forming a back about 2 in. wide, as per annexed diagram,



Portfolio for Weekly Numbers of WORK.

A, A, Sides of Millboard. B, Back of Cloth. C, C, Ribbon.

and fastened a bit of ribbon to the outside of each board, with which you can tie boards together after placing weekly part within. If desired, I will send instructions how to make a blotting folio or pad."—[You can send these if you like.—ED.]

Utility of WORK.—JOINER writes:—"I beg to add my testimony to the immense value of your paper. I have showed it to many of my fellow workmen—some of whom are subscribers—and they all agree with me that WORK is the best and most useful paper of its kind that has as yet been published. It is a paper which claims the attention of every right-thinking and right-acting man, whether he be a professional mechanic of whatever trade, or a man of independent means, who takes up any craft merely as a hobby."

Patents for Inventions.—P. J. (*Royston*) writes:—"I think working men will appreciate your kindly offer which you made to W. J. P. in No. 8. There is a great number of working men who have inventive genius, which is lost through not having the wherewith to patent their inventions. I would suggest that a subscription be got up in WORK for the purpose of helping those who cannot help themselves. I am sure, sir, if any working man got help through that means and prospered thereby, he would not forget those who helped him."

Gold Leaf.—PAINTER writes:—"I notice in 'Tips for Tyros,' by OPIFEX, in No. 8 of WORK, that a book of gold leaf, which is quite good enough for such purposes, can be bought for 6d. Having had some little experience as a painter and decorator, I feel bound to say that if you want work to stand, it must have something better than so-called gold, at 6d. per book. The best material is much the cheapest. For this work buy a book of 'transfer gold' at any good oil and colour shop. It will cost about 1s. 3d. The gold is already transferred on loose leaves which interleave the book, and only needs to be lifted or drawn out, and then cut up as needed. In winter, use quick-drying gold size; in summer, use slow-drying gold size. The gloss is almost sufficient to hold it."

Utility of WORK.—AJAX writes:—"Being a constant reader of the SATURDAY JOURNAL, it was with pleasure that I saw the announcement of your new publication, WORK—not so much for the hints it is likely to give me regarding my own trade (cabinet making), as the information I may get from it respecting other trades. I shall put each number carefully away, so that my son, who is now ten years old, may have the benefit of them when he is older."

Elizabethan Twist in Lathe.—C. C. E. writes:—"Permit me to make a slight correction. I did not say that an Elizabethan twist cannot be cut in a lathe (I believe a lathe might readily be constructed to cut one, at any rate, in hard woods and ivory), but that I do not believe there is any lathe in existence by which they can be produced. You ask why, if a spiral groove can be cut, cannot the sharp edge of the groove be removed, and the twist finished without rasp or file? No doubt it can, and by apparatus too complicated to describe, very fairly be done; but if you will go to your lathe and try to make a convex curve die into a concave without a break, you will soon realise the difficulty, and, justly proud if you succeed, will yet have to confess that it is not in the range of practical mechanics. During a hunt of some thirty years I have met many such men as you describe, and with precisely the same result. The lathe which produced the twist is always somewhere else, and you can never 'run it to ground.' Lathe-users, not generally lathe-makers, are the men to assist us in difficulties. It is one thing to make a piano, but quite another to play upon it. And pig-headed though I may appear, I am of the same opinion still, 'that there is not any lathe in existence by which a true Elizabethan twist can be produced,' and I shall be very glad indeed to be proved wrong."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Papier-Mâché for Outdoor Work.—"PAPIER-MÂCHÉ" (*Burnley*).—Outdoor ornamental work, such as for palisades, can be made from paper pulp, and the moulds used would be of cast iron. Thoroughly japanned, such work would resist weather alone for a considerable length of time. But exposed as it must be, it could scarcely escape accidental injuries, which, letting in the damp, would ruin it. On the whole, cast iron would be both cheaper and better. Pulp on a large scale would be more cheaply bought than made. Messrs. Rubery & Evans, of Birmingham, used formerly to supply it, and probably do still.—S. W.

Tools for Repousse Work.—W. E. S. (*Oldham*).—These may be obtained of Gawthorp, 16, Long Acre, London, who also supplies all materials necessary, and makes the special cement referred to in the article. The simplest method of transferring design to metal is to place a sheet of carbon paper between the design and the metal (the *black* side being in touch with the metal), then trace over the whole of the design with a blunt steel point, and the design will be found in black upon the metal. Scratch this in with a sharp steel point to avoid rubbing out. To smear the metal with turpentine, and allow it to dry before tracing with carbon paper, or drawing with lead pencil, is a good tip.

Electrotyping with Bunsen Battery.—ELECTRIC.—The Bunsen battery is not suited to this work, because its E.M.F.—that is, the intensity or pressure of the current—is too high to produce *tough* copper. I should say that you get a good tough deposit from your 3-gallon Smee. If you wish to increase the rate of the deposit, add more cells as the deposit spreads, and connect each cell to the work by a separate wire; 60 square inches of copper plate ¼ in. in thickness will weigh about 29 lbs. Copper is deposited at the rate of 17 grs. per hour for each ampère of current passed through the solution. It will take 50 ampères of current per hour to deposit 60 square inches of copper ¼ in. thick in 10 days, and this cannot be obtained from a single-cell 3-gallon Smee. Are you sure as to the dimensions of your electrotype? An eighth of an inch is thick for an electro.—G. E. B.

Tea-Chest Wood.—BARRINGTON.—Thank you for the specimen of tea-chest wood sent to me. It is a very decent kind of wood for working up into articles for home use, as you said, and I am glad to have had it brought under my notice. It is possible the chests came from India, for all tea-chests I have seen from China are made of thin hard wood that will split at the slightest provocation. There will be no chance of discussing the subjects to which you allude in the pages of WORK. They are strictly tabooed; so your mind may rest relieved of any apprehension of squabbles over well-gnawed bones of contention, that no really reasonable man would care to discuss.

Tea-Chest Wood.—J. S. W. (*Norwood*).—I am obliged to you for the sample of Indian tea-chest wood sent, which, as you say, "is not at all a bad-looking wood—in fact, very much like black walnut." I append the rest of your letter, which conveys much useful information, and runs as follows:—"I have seen numbers of chests of the same kind at Cooper Cooper's, King William Street (London Bridge), and they could be procured at any large tea merchants. I remember seeing an article not long ago, but I quite forget where, by a gentleman in India, in which he said that Indian, and particularly Ceylon, tea-chests were often made of quite valuable woods. He had come across one himself made of a beautiful spice wood, which he had had made up into some article by a native workman, and which was well worth it. The sample I send is part of a chest from North India. I am delighted with WORK. I have recommended several friends to take it, with success."

Hand-Loom Weaving.—G. O. (*Sheffield*).—I trust a beginning will soon be made in this direction with a spinning wheel and a simple loom. It is desirable, in dealing with such a subject as this, to begin at the beginning, and these preliminary papers will be most useful in the colonies—Manitoba, for example, where they have plenty of wool and no machinery for working it up into yarn and cloth.

Binding Screws and Clamps for Battery.—A. A. (*Grantown-on-Spey*).—These may be bought of any dealer in electric wares. The price of the binding screws for the zincs should not exceed 8d. each; the clamps may cost from 1s. to 1s. 6d. each, according to width of jaw, ranging from 1¼ in. to 1½ in. If you cannot get them at Inverness or Perth, you may have them sent by post from Messrs. H. Dale & Co., 26, Ludgate Hill, London, E.C.—G. E. B.

Carbons for Bunsen Battery.—M. I. (*Horsham*).—Your perseverance in trying to make carbons for the Bunsen battery is very creditable, and if this alone could command success it would certainly be assured. Every man to his trade, and this must be gained by experience. Carbon moulding and baking is a trade by itself, and there are several little wrinkles in this, as in all other trades, not revealed to outsiders such as myself. I believe, however, that the coke must be ground to fine dust, and this mixed with fine dust of *caking* coal. The mixture is then pressed into a strong iron mould of the shape required for the carbon, and heated strongly in a furnace. The baked mass is found to be porous (as your carbons were) when the mould is opened. The porous mass is soaked in gas-tar or in sugar syrup, and again heated in the mould. This process is repeated until the carbon block has acquired the necessary solidity. If you still intend to persevere in trying to make the carbon blocks, I hope this will help you. But why try to make carbons for this, or for the single-fluid bichromate battery, when you can get carbon plates ¼ in. thick for about 1d. per square inch?—G. E. B.

Electric Lighting by Accumulators on a Small Scale.—YORKSHIRE.—(1) To estimate the capabilities of an accumulator for electric lighting, calculate each square foot of positive surface plates to yield six amperes of current per hour. Find out the resistance of the lamps, and calculate one pair of elements, or 1 cell=2 volts, to each 2 ohms of resistance, including that of the connecting wires. As 10 c. p. lamps vary in their resistance, I cannot say what would be the resistance of five of these. If we put it at 20 ohms each, and the five are arranged in series, we shall get a total resistance, including the leads, of, perhaps, 102 ohms; this will require an E.M.F. of 102 volts, obtainable from 51 cells arranged in series. If the plates in the cells are each 1 square foot, the battery will probably furnish light to this number of lamps for five hours. By using a battery with plates having an area of 5 square feet, and coupling the lamps in parallel, eleven cells will furnish the same light for five hours. (2) The second part of your query contains an almost impracticable demand. Of course it is possible to connect a motor to a sewing machine, and to cause the motor to generate a current capable of charging an accumulator by reversing its action and treading the other way. But who would undertake to devote himself to such drudgery? You would have to exert 20 per cent. more power during five hours to charge the accumulators than would be required to work the machine itself by the foot! When an accumulator is charged, the bubbles of gas shift over to the opposite plate, and the cell discharges itself, if not disconnected from the machine. (3) A secondary battery, *i.e.*, an accumulator, will work a sewing-machine motor very well. The chromic acid battery is said to be the next best for the purpose, and is generally used when primary batteries are employed for this purpose.—G. E. B.

Sale and Exchange Column.—F. J. B. (*Kensal Green*).—I note your reply to F. T. (*Bristol*), relative to a Sale and Exchange column in WORK. I think it would be very popular, and shall be glad to give it my support.

Address.—JACK PLANE.—We cannot give you the address you ask for, as we have not got it on record.

Bicycle Making.—W. E. (*Kirkcaldy*).—This is a subject for winter work. It would be impossible to give instructions which would enable bicyclists to make their own machines for use this summer, which is already upon us.

Harp Making.—G. L. (*Sheffield*).—Your request shall not be forgotten, but it is impossible to enter upon the subject at present.

Enamelled Paper Letters.—J. W. (*Bradford*).—Enamelled adhesive waterproof advertising paper letters and figures, ornamentations, etc. etc., may be had from the sole and original manufacturers, S. H. Beit & Co., 4, Hyde Street, New Oxford Street, W., who will forward price list and sample sheet on enclosing stamp for postage.—N.B. The nearest on their sheets to samples sent is No. 20 ¾ in., which is a very near match.—H. L. B.

Photographic Camera.—G. L. (*Sheffield*).—Instructions for making a camera will be given shortly.

How to Make a Wardian Case.—W. P. (*Southport*).—An article on this subject will appear shortly.

French Polishing.—T. W. (*Leek*).—Articles on this subject will be commenced very shortly.

Electric Motors, etc.—J. S. (*Orkney*).—Articles upon all these are in preparation, and will appear in due time.

Treadle Fret Saw, etc.—E. G. (*Malvern Link*).—A member of my staff, who is an accomplished fret sawyer, has this subject in hand.

A Patent: Its Cost and How to Get It.—A. M. (*Birmingham*).—If you have not read reply on this subject to P. T. S. (*Sheffield*) in No. 12, p. 189, please do so, as you will find in it a sufficient answer to your query. You can get the £1 form for application for provisional protection at the chief post office in Birmingham.

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Mixing Colours.—C. S. B. (*Glasgow*).—Papers on house painting and decoration will appear shortly, and in these the subject of mixing colours will be carefully considered.

Sign Writing and Lettering.—H. C. (*Camden Town*).—We have some more of these papers, and their publication has been resumed, as you will have seen before this meets your eye.

Magic Lantern Slide Painting.—T. A. G. (*Stratford*).—This subject will be treated in due time, but the present season is scarcely the right opportunity for me to commence it.

Greenhouse.—SIGNALMAN.—You will have seen in No. 12 of WORK instructions for building such a greenhouse as you want. Do not hesitate to ask me anything about gardening and garden appliances, for gardening is one of my hobbies, though I have very little time to indulge in it, as you may suppose. You say you have made three hand-lights. It will interest you, then, to know that I hope soon to be able to tell you about an entirely new thing in this kind of appliance which I have been testing for some time, and find to be a most useful article.

Fret Machine.—JOINER (*Glasgow*).—The subject has my attention. I quite agree with you as to its utility; but you, as a canny Scot, will know that everything can't be first. Thanks, all the same, for the suggestion. Meanwhile, you do not say whether you have a lathe or not to which you fit an arrangement for fret cutting.—D. A.

Finishing Fretwork.—M. C. (*Nottingham*).—French polish decidedly, rather than varnish. Polish the wood in the usual manner before cutting, or, if the fret is already made, polish without using any filling.—D. A.

Plane for Cutting Rebate.—A. D. (*Canonbury*).—You say there is a "mistake in thinking, or, rather, saying, that a rabbet plane is used for the purpose of making a rabbet or rebate," and that "the plane used is either a sash fillister or side fillister, according to the work that is being done. A rabbet plane is only used for reducing a rabbet or anything similar, if required in fitting the work together. It is a mistake that most writers on woodwork fall into unless they are in the trade." I cannot agree with your remarks about this. In making up such work as that described, few cabinet makers would use any but the rabbet plane. It would be simply a waste of time to set the fillister if only a single article were being made, and be quite contrary to custom to do so. In the joinery or building trades the tools you name are no doubt preferable, as you say, "according to the work being done." Even in cabinet work the side fillister is sometimes useful, though not generally; and it may astonish you to hear that many cabinet makers with a good stock of tools do not possess one. The other, as far as I am aware, is never, or but rarely, used by cabinet makers. You have, I fear, yet to learn that in different trades, or branches of the same trade, different tools are used. Because one man prefers to use one in preference to another, it does not follow that it is a "mistake." Writers on the construction of furniture, if they know what they are writing about, certainly will very often fall into what you are pleased to call a mistake, especially when they are "in the trade" (cabinet making), as the writer of the article you refer to is, and has been for many years.—D. A.

Paper Replicas of Relievo Subjects.—G. M. (*Calvine*).—The reliefs referred to in "'Tips' for Tyros," April 6th, are issued in series of twelve each by MM. Monrocq Fres., 3, Rue Suger, Paris. Series D are classical heads. I am sorry I cannot give a definite address where they are retailed in this country, but try Messrs. Gawthorp, 16, Long Acre, London. I shall be happy to send querist a specimen, should he desire it.—OPIFEX.

French Polishing.—E. B. (*Lymington*).—Unless you are acquainted with the process of French polishing generally, it is impossible in a short space to give such an explanation as is likely to be of service to you. If you want to know how to polish any particular wood, let me know, and I will direct you; but your present question is far too general to be answered in this column. Briefly, the process consists in coating the wood with a film of lac, which, dissolved in spirits, is the principal ingredient of French polish. This is rubbed in till the spirit has evaporated and a bright surface is obtained. In some woods it is necessary to fill the grain with filling, and the colour is generally improved by oiling. Both filling and oiling are generally done, and light wood is often stained.—D.A.

Joints and Cabinet.—R. M. W. (*Burnley*).—Don't apologise for troubling me. Letters such as yours are not regarded in that light. The desire is to make WORK useful, so that practicable suggestions and encouragement are always welcome and cheering. I am glad you, among others, have found the friendly hints to amateur woodworkers helpful. Mr. Denning, to whom your thanks have been conveyed, has papers on both the joints you name in preparation, as well as other topics of a similar character, all of which, no doubt, you will find of assistance, and your "sincere hope" is cordially re-echoed. The cabinet—by which, if I am right in thinking you mean the piece of furniture commonly known among cabinet makers as a nest of drawers—will have attention at an early date. In case you do not understand what a nest of drawers is, I may say it is a kind of square-cornered pedestal fitted with drawers only. These run from side to side, and are usually secured by one lock fitted on a hinged style to the right of them. If this is not the kind of thing, let me know, and I will see what can be done to meet your wants. In any case, I think I may safely promise that sooner or later a description of whatever the piece of furniture you wish to make will appear in WORK. Why not send me a rough sketch or diagram of the article? No matter how roughly drawn, a sketch often shows more plainly than any description what is really required; and when the subject seems likely to be of general utility, you may be sure that arrangements will be made for a paper on it. I am pleased to hear you are making one of the tables described in No. 1, and I trust it will come up to your expectations. Thanks for your good wishes.—D. B.

Tin-Plate Working.—W. H. F.—A thoroughly competent man has this subject in hand, and his papers, I trust, will soon be commenced. By all means give the readers of WORK the benefit of your experience by "talking 'Shop'" whenever you feel inclined to do so, and by writing papers on any particular subjects connected with your trade which seem to you to require elucidation. You are right in saying, "I think if greater help were given by those well up in their respective trades, we should have a healthier body of workers, and the country at large would be greatly benefited by it." Yes, there is nothing like mutual assistance; like mercy—

"It is twice blessed;
It blesseth him that gives and him that takes."

By helping one another through the medium of WORK, workmen will be able to do much to improve the quality of work done throughout the kingdom and the empire at large, and to foster that enthusiasm in one's work without which no work, be it what it may, is thoroughly and effectively done. Enthusiasm is the very soul of work, the begetter of success, and no man can hope to produce, create, or make or do anything approaching to excellence unless he enters heart and soul into his labour, and has pride in, and respect for, the work of hand or brain.

Papier-Mâché Boat.—S. T. (*Shepherd's Bush*) does not state whether this is intended as a mere model, or toy, or as a boat for actual use. A toy boat in papier-mâché will stand water, and last a long time, with only ordinary japanning. If, however, it is to be left swimming on the water much, it will be well to give it a couple of coats (nail-heads, if any, and all) of boiled linseed oil before japanning. If the boat projected is for actual use, S. T. is warned that papier-mâché is a material highly sensitive to changes of temperature; that all copal varnish, which would, when thus used, be liable to crack, should be avoided, and that wooden ribs would be necessary. For this purpose two or three coatings of the boiled oil, before japanning, would be desirable. Any injury should at once be stopped with the paper-dust and japan varnish compositions, and the whole re-japanned. It is doubtful whether the grey paper expressly made for the papier-mâché trade is still in the market; but any paper warehouse could supply a porous paper of medium weight proper for the purpose.—S. W.

Book on Plumbing.—A. H. (*Gosport*).—Buchan's "Text Book of Plumbing," 3s. 6d., Lockwood and Co., is the only one I know. Hellyer's "Plumber and Sanitary Houses," 4th edition, 10s. 6d., Batsford, is a good book, but I cannot say whether it gives what you require.

Wood for Violin Making.—FIDDLER (*Highbury*).—I do not know of any one (beyond the wholesale dealers) who makes a business of selling violin wood; but if FIDDLER experiences any difficulty in getting what he requires he can be supplied from my own stock.—B.

Government Patent Office.—W. R. (*Hulme*).—The Government Patent Office, to which specifications of patents must be sent, is the Great Seal Patent Office, Southampton Buildings, Chancery Lane, London, E.C. You can obtain stamped forms for patent purposes at provincial post-offices.—F. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Resilvering Looking-glasses.—R. C. (*Bingley*) says:—"Being a subscriber to your valuable paper since its commencement, I venture to ask you, or any of your numerous subscribers, if you could inform me how to resilver looking-glasses, trusting you will excuse my encroachment on your time and space."

Making a Xylophone, or Dulcimer.—CORRESPONDENT writes:—"Could you, or some musical correspondent, give me a few hints on the construction of the xylophone or wooden dulcimer? What is the best sort of wood for the purpose, and where can I get it? Do you know of any information, article, or papers on the subject?"

Resilvering Glass.—J. S. (*Taunton*) wishes to know what the solution or mordant may be that is poured on the glass in this process after it has been washed with pure whiting and putty-powder and distilled water. He also asks where he may be able to obtain it. Further, he wishes to know the right shape and proper material for the leather squeegle, which is used to wipe over the glass, and remove the surplus solution, after another solution of nitrate of silver has been poured over the glass, and the silver precipitated by the action of the mordant on the second solution.

Trade Notes and Memoranda.

SIR JOHN LUBBOCK recently laid the foundation stone of the Battersea Free Library.

DURING the course of the present exhibition at Paris, no less than sixty-nine International Congresses will meet under Government patronage, besides others of a non-official character.

ANOTHER, though less brilliant, illustration of the happy union of scientific with commercial pursuits is afforded by the career of the late Mr. R. S. Newall, of Gateshead. He was the pioneer of wire rope manufacture, and the earlier submarine telegraph cables were turned out from his works at Gateshead. The 1850 cable between Dover and Calais; the Holyhead, 1852; the Dover and Ostend, 1853; the Black Sea, 1855; the Red Sea, 1859, were made by his firm. He was devoted to astronomical pursuits, and had a 25-in. repeating telescope made by Cooke, of York, which, shortly before his death, he presented to the University of Cambridge. He was an F.R.S. and an F.R.A.S., was twice mayor of Gateshead, and had been requested to fill the same office during the present year, on the occasion of the visit of the British Association to Newcastle.

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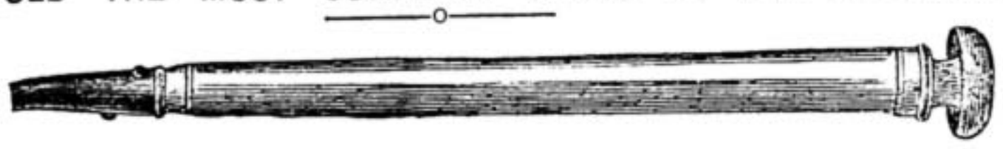

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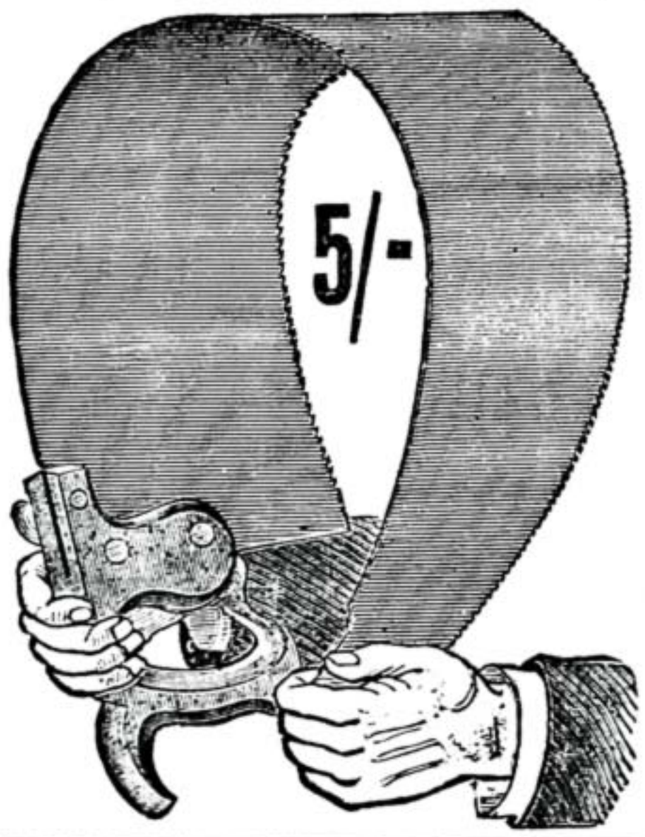

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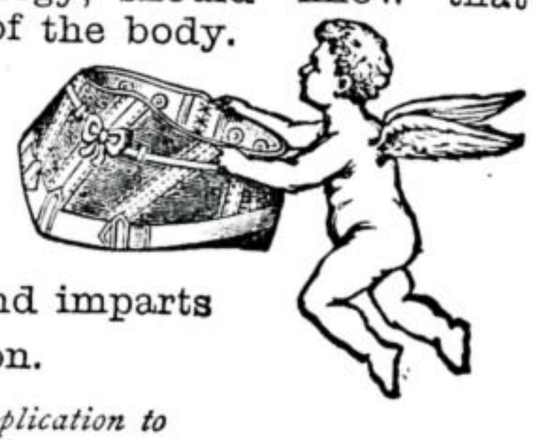

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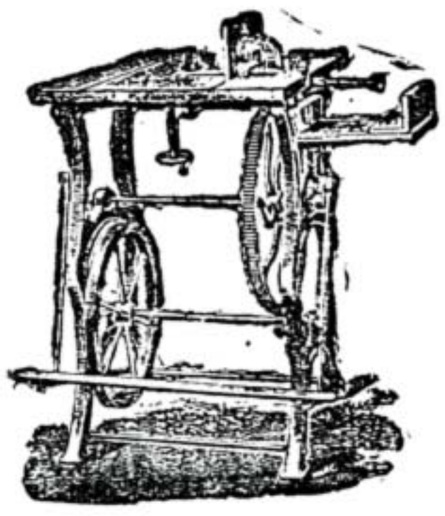

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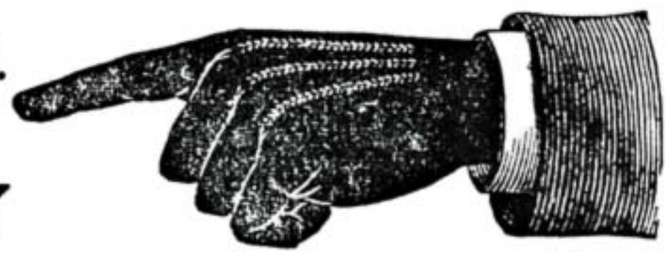

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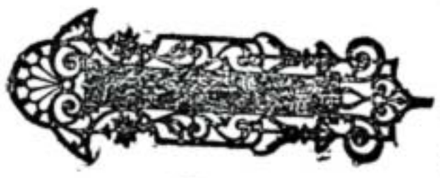

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